Robert L. Thorndike
Elizabeth Hagen

10,000 CAREERS

This book . . .

. . . reports the outcomes of a study of 17,000 men who were given a battery of aptitude tests in 1943. In 1955 and 1956 information was obtained from over 10,000 of these men about the educational and vocational history of each. The analysis of aptitude test scores for these 10,000 men in relation to their later careers provides the substance of the work.

The authors have found out what kind of work each man is now doing and have also tried to get at least rough measures of his success in the occupation. For this last, they have used his reported earned income, his self-rating of success and satisfaction, and their over-all appraisal of his occupational stability and progress.

The 10,000 cases have been subdivided into over 100 groups, each representing a single occupation or group of closely related occupations. For each of these groups the authors have found the typical or average score on each of the tests. In addition, they have studied each of the tests in relation to each of the job groups, and determined to what extent the test scores predicted success in the occupation, insofar as they were able to estimate success.

The study is completely unique with respect to (1) the size of the group, (2) the comprehensiveness of the test battery, and (3) the length of time over which the group was followed up. It promises to be the major source of data for anyone teaching or working in the field of vocational guidance or personnel selection.

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Preface

An investigation such as the one reported in this book can be completed only through the help and cooperation of many individuals and organizations. Although any statement that we can make of our indebtedness is necessarily incomplete, we are nevertheless pleased to make explicit acknowledgment of some of our main sources of help, both material and spiritual.

The study was financed by the Grant Foundation. Our initial contacts in 1954 were with Mr. Perrin C. Galpin, at that time Executive Director of the Foundation. After Mr. Galpin's retirement in 1955, Mr. John G. Byler, who succeeded him as Executive Director, continued an active and informed interest in the project's activities. Miss A. W. Morrison, Associate Director of the Foundation, was helpful in numerous administrative and fiscal matters.

The Grant Foundation supplemented our original budget request with funds for an Advisory Committee, to provide stimulation and review in the planning and conduct of the study. The members of this Committee were generous in their contribution of time and produced many wise and helpful suggestions. Their membership consisted of the following:

George K. Bennett, President: The Psychological Corporation.

Ralph F. Berdie, Professor of Psychology and Director of Student Counseling Bureau: University of Minnesota.

John C. Flanagan, Director of Research: American Institute for Research.

Lloyd G. Humphreys, Professor of Psychology: University of Illinois.

Irving Lorge, Professor of Education and Executive Officer: Institute of Psychological Research, Teachers College, Columbia University.

Joseph Samler, Assistant Director for Counseling: Veterans Administration, Washington, D. C.

Donald E. Super, Professor of Education and Research Associate: Horace Mann-Lincoln Institute, Teachers College, Columbia University.

John T. Wilson, Program Director for Psychology: National Science Foundation.

Dael L. Wolfle, Executive Officer: American Association for the Advancement of Science.

The study had as its foundation Air Force testing during World War II. The basic test scores and Biographical Data Blank answer sheets were supplied by the Personnel Research Laboratory of the Air Force Personnel and Training Research Center, of which Dr. Lloyd Humphreys was at that time Director. The necessary test materials as well as assistance in making other necessary military contacts were provided by Dr. Frank Ford, Chief of the Machine Processing Section in the Laboratory.

Major aid in obtaining addresses for the men in the sample was supplied by the Veterans Administration through its central locator file. Cooperation of the Veterans Administration was graciously extended by Mr. Harvey V. Quigley, Administrator of Veterans Affairs. The operating details of VA support were ably handled by Mr. G. J. Kane, Assistant Chief of the Office Services Division.

Important further help in locating the individuals in the group was furnished by several military records agencies. These included the Army Records Center, St. Louis, Missouri, the Air Force Reserve Records Center, Denver, Colorado, and the Personnel Records Service Division, Air Force Headquarters, Washington, D. C. Administrative and clerical personnel of these agencies were uniformly cooperative and efficient in providing needed information.

The work of communicating with the men in the sample was facilitated by using two commercial agencies. The St. John Associates, 75 West 45th Street, New York City, handled the voluminous clerical detail associated with mailing out a series of questionnaires to a sample of 17,000 individuals. The Retail Credit Company, with branches throughout the United States, reached by telephone or call a sample of those who did not respond to our mail inquiries.

The basic IBM record keeping and statistical analyses for the project were carried out by the Institute of Psychological Research at Teachers College under the direction of Dr. Irving Lorge. Computer time on an IBM 704 Electronic Data Processing Machine was donated to the project by the International Business Machines Corporation. This made possible the calculation of validity coefficients and regression weights for twenty tests and seven criterion variables for some eighty occupations. The good offices of Dr. W. J. Eckert of the Watson Laboratories in arranging for this service are gratefully acknowledged.

Some correlational analyses and a very laborious solution of a multiple discriminant function were carried out at the Educational Research Corporation, Cambridge, Massachusetts, under the direction of Dr. Phillip J. Rulon.

Finally, we are happy to express our appreciation to the men and women who worked with us on the staff of the project. Their number makes it impossible for us to mention each individually. As a team, they did an outstanding job in carrying a laborious and exacting project through to completion.

R. L. THORNDIKE
E. P. HAGEN

May, 1959

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PART I

CHAPTER 1

The Background of the Study

Today the use of aptitude tests on a broad scale to provide information contributing to decisions in education, in government, and in industry is an accepted practice. Such tests have been available for some 40 years. Large-scale use received a major impetus from the testing in World War I and has continued ever since. The pattern for a battery of differential aptitude tests was clearly formulated by Hull (6) in 1928, and the logic for the development of efficient differential tests has been developed in the factor analytic approaches of Kelley, Thurstone, and many others. Testing for use in school counseling programs and in industrial selection has been widespread for a generation. One might think, then, that there would be a large, well-organized body of knowledge on the validity of tests as predictors of vocational careers. However, available data fall far short of what we need to use tests most effectively.

Ideally, we would like to know for any occupation (1) what the men (or women) now in the occupation were like at the age when they were deciding to enter the occupation, that is, at the age when vocational guidance might have been given them, and (2) what measures of ability or personality administered at that time would have predicted their later success or satisfaction in the occupation. This information would help us to guide future groups of young people toward the occupations that they would have a good chance of entering and in which they would have a good chance of being successful.

This information is not easy to come by. In the first place, it implies a follow-up of the same individuals over a period of years—from the time they were initially deciding about their vocational futures to the time when they are stably established in their vocations and have demonstrated their level of performance. In the second place, it implies testing a large enough group so that the numbers in a given occupation will be adequate to provide dependable statistics. The necessary group tends to become very large. If the testing is done in advance, of course we cannot be sure of the occupation in which any given person will end up. We cannot test lawyers-in-embryo. We can only test boys and girls or young men and women. Inevitably, we must study all occupations at once across the spectrum of jobs. Again, if testing is done in advance, we must give a complete battery of tests to each individual. Since we do not know into what occupation he will be going, we cannot select (even if we otherwise could) a special battery that would be the most appropriate for his occupation. Thus, the type of study that is ideally required is one in which (*a*) a comprehensive, uniform battery of tests has (*b*) been administered at about the age at which vocational guidance is typically given to (*c*) a group large enough to provide stable statistics for each major occupation and (*d*) this group has been followed up at a time when they have become established in their work.

Investigations that follow out this ideal pattern are few indeed, and it is easy to see why. In the past the research worker in vocational testing has rarely had sufficient funds (and perhaps patience) to test a sample of adequate size with a comprehensive battery, to follow them from adolescence through to the time when they were well established in their occupations, and to analyze the host of relationships that then emerge between test scores on the one hand and job measures on the other. The time span for such a follow-up probably should be at least 10 years in order to permit almost all of the group to complete training and get established on the job. The group initially tested in such a follow-up study needs to be very large, because of the simply tremendous scattering of men into different occupations. We found in a pilot study based on 1500 cases (9) that the largest reasonably homogeneous occupational group was one made up of 54 engineers of all types. Returns were received from over 800 persons, and these were scattered in 154 of the occupational groupings used in the 1950 census. As we shall see later, the 17,000 cases of the present study are still too few to provide adequate samples in many occupations of great importance that employ large numbers in our working population. With a host of occupations, a comprehensive battery of tests, and possibly several indicators of success in each occupation, the volume of statistical analysis becomes very great indeed. In the present study, for example, approximately 12,000 correlations of tests with job measures were computed, as well as many other statistics.

There is much important work, of course, on tests in relation to occupational success. A classic study is E. L. Thorndike's follow-up (8) of 2225 eighth-grade pupils tested in New York City in 1921 to 1922. The test battery was somewhat limited, consisting of arithmetic and reading tests, a test of "clerical intelligence" and one of clerical speed and accuracy, and a mechanical assembly test. The study did not attempt to study specific occupations, but rather evaluated success in general terms over the whole range of occupations. In general, the correlations of test scores with appraisals of later success were quite low. The U. S. Employment Service has done a great deal of work with the General Aptitude Test Battery, reporting the level of score for men in different occupations and correlations of specific tests with success in the occupation. These studies have, however, usually been based on persons already employed in the occupation, in one or more plants, rather than upon young people who later went into the particular line of work. Bennett, Seashore, and Wesman (1) have followed up a group of 2900 high school students who had been tested with the Differential Aptitude Tests, and have been able to report test profiles for a limited number of educational and occupational groups, based usually on rather small N's and rather broad occupational groupings. There have been a host of specific studies in which a few tests have been related to success in a specific job or two or three jobs. No systematic review of past work is attempted here. Ghiselli (4) has undertaken to integrate the results from many of the studies reported in the literature. However, the body of evidence on tests as long-range predictors of occupation entered or of subsequent success in an occupation is very limited. It is this gap that our study tries in part to fill.

This book is devoted to reporting the outcomes of a study of 17,000 men who were given a battery of aptitude tests in 1943. An attempt was made to locate as many as possible of these men in 1955 to 1956 and to get information from each about his educational and vocational history. Information has in fact been obtained from over 10,000 men who were out in the civilian world of work. The analysis of aptitude test scores for these 10,000 men in relation to their later careers provides the substance of our work.

The present investigation became possible as a result of the program of aircrew testing in the Army Air Force during World War II. This program was initiated in July 1941 by the Air Surgeon, Major General David N. W. Grant, as a part of the appraisal made by the medical staff of each man's suitability for flying. At that time Major General Grant brought Dr. John C. Flanagan into the Army Air Force to take direct charge of the psychological testing program. Under Dr. Flanagan's direction the program of testing for Aviation Cadets rapidly took form, and a staff of competent psychologists was assembled to be responsible both for the conduct of testing and for research designed to improve selection test procedures. A standard selection test battery, set up to differentiate between potential pilots, navigators, and bombardiers, was in operation by July 1942. As research data accumulated on the validity of selection tests for predicting success in training, the battery was changed from time to time. Between 1942 and 1946 the battery of tests was given to over a half a million men.

Since research on the effectiveness of the test battery was being carried out continuously during the war, it was necessary to have a centralized record system in which the test scores for any man would be available for use in statistical analyses and research studies. A centralized IBM machine records system was set up, which became a repository for all test scores. Fortunately, these records had been kept up to the time this study was undertaken. They had suffered somewhat from the passage of time and from shifts of jurisdiction, but in large part they were still in usable condition. Thus we had a file of test scores for tests administered to 500,000 men 10 to 15 years earlier.

Although the aircrew test battery was developed purely for military purposes, it included tests of many of the functions that would be interesting to a civilian guidance counselor. To identify potential pilots there were measures of perceptual speed, visualizing, mechanical comprehension, and motor coordination. Tests for navigators included measures of numerical, mathematical, and verbal ability. Bombardier selection added on measures of reaction speed and finger dexterity. Although certain tests are complex and hard to picture clearly in terms of standard test dimensions, collectively they cover many significant ability dimensions. The tests in the July 1943 battery, the one on which the present study is based, will be described briefly in Chapter 2 and in more detail in Chapter 4.

Although it is hard to vouch for testing conditions throughout a large-scale and geographically dispersed enterprise, there is much evidence that the testing was carefully and competently done. Certainly, there were enough able psychologists in the program to assure that this would be true. Furthermore, compared with other military testing the Aviation Cadet testing was a relatively unhurried enterprise. A day-and-a-half was allotted to it during the period of initial orientation and processing into training. Test administrators and proctors were carefully trained. Systematic checks were run on apparatus and on scoring procedures. In general, we believe that the quality of testing was at least equal to and probably superior to that which would be encountered in most industrial or educational testing.

The program of Air Force aptitude testing during World War II has been fully reported in the series of Army Air Force Aviation Psychology Program Research Reports. A general description of the program is provided by Flanagan (3), and the historical details of the development of the program and the content of the specific test batteries are provided in a volume by DuBois (2). Paper-and-pencil tests, both those used for classification testing and those developed for research purposes, are described by Guilford and Lacey (5), and a companion volume by Melton (7) describes individual apparatus tests. These are the volumes in the series that are of greatest interest in relation to the present study.

During 1952 and 1953 it was possible to carry out, as part of a research contract with the Personnel Research Laboratory of the Air Force's Human Resources Research Center, a study of a sample of 1500 men who had been tested in 1943. This pilot study demonstrated the feasibility of getting in touch with a large fraction of the men and of getting information about their postwar educational and occupational histories. The pilot study yielded a number of interesting occupational profiles and a scattering of promising test validities. With evidence of the feasibility of the project from the pilot study, we were able to obtain support from the Grant Foundation for a study on a more adequate scale. Pooling financial support from the Grant Foundation with logistic support from the Air Force (test scores), the Veterans Administration (addresses), and the Educational Research Corporation and International Business Machines Corporation (computing), the study has been able to move forward to a successful conclusion.

This report is organized in three main parts. Part I, which includes this chapter and the following two chapters, gives an overview of the whole enterprise. Chapter 2 describes our procedures in broad outline, indicating the nature of the experimental population, the contents of the aircrew test battery, the procedures for gathering occupational data, and the plan of statistical analysis. Chapter 3 gives a condensed summary of the results, presenting the main trends of the findings, some compact summary tables, and a general discussion of the limitations of the study that must be borne in mind when interpreting the findings. The reader who is interested in a quick overview of the study can obtain it by reading only Part I.

Part II presents a more detailed statement of our procedures. Chapter 4 describes the aircrew tests in some detail, and gives more information about the Aviation Cadet population and the procedures for selecting our sample of 17,000 from it. Chapter 5 describes the techniques used in locating the men of our sample, and describes the information that was obtained from or about each. Chapter 6 reviews the problems of organizing the material for statistical analysis—primarily problems of organizing and coding the material so that it could be handled by machine methods. In Chapter 7 the plan for statistical analysis and the problems of handling the statistical results are considered.

Part III of the book presents the substantive results for specific occupations. It consists of a series of chapters, each dealing with a group of occupations. The occupational groups are described, profiles of test scores for the occupations are presented, and the biographical background items that differentiate the occupation from respondents-in-general are discussed. Validity coefficients for specific occupations are not presented because, as discussed in Chapter 3 and Chapter 7, there was not enough evidence that the obtained coefficients differed significantly from a chance distribution. A final chapter presents a multiple discriminant analysis of a subset of 22 occupational groups.

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CHAPTER 2

Gathering the Data

In this chapter we shall describe the population from which our research sample was drawn and the procedure for selecting the sample. Then we shall identify and briefly characterize the test data that were available for each man. We shall continue by describing the follow-up data and the manner in which they were gathered. Finally, we will review the procedures that were employed for coding the data and analyzing the results.

THE BASIC POPULATION AND THE RESEARCH SAMPLE

The basic population from which we drew for our study was that of applicants for Aviation Cadet training in the Army Air Force in World War II. What do we know about these men? There were, first of all, the formal requirements set by the Army Air Force for entry into Aviation Cadet training. To be accepted a man had to be single, be between the ages of 18 and 26, pass a fairly rigorous physical examination, and pass a screening aptitude test, the Aviation Cadet Qualifying Examination. This examination was primarily a scholastic aptitude test, though perhaps with a slightly technical and mechanical slant. The qualifying score on the screening test was set at a level that could be reached by approximately half the high school graduates, the country over. Thus, essentially all the men in our basic population were young, single, in sound physical health, and of at least average mental ability. In addition, they were all volunteers for flying training, with whatever that may imply by way of interest in mechanical things, desire for adventure, desire for officer status, or desire to avoid other phases of military life.

The Aviation Cadet population consisted of over half a million men. Our resources permitted us to follow up only a small fraction of this group. We started out with approximately 17,000 men. These men had all been given exactly the same battery of tests and had all been tested during one five-month period—from 1 July to 1 December 1943. The men were chosen so as to be representative of the 75,000 men to whom the battery of tests had been given during this period. They were from all parts of the country, and included men tested during all the months that this specific test battery was in use. Average age was slightly over 21 years and average education slightly over 12 years. Most of the men were high school graduates. Many had had some college training, and many had worked for anywhere from a few months up to several years before they entered the Air Force.

THE TEST BATTERY

The test battery in use from 1 July to 1 December 1943 yielded twenty scores, though in two instances two distinct scores were obtained from a single testing instrument. The scores are named below and described briefly in terms of their content and the factors that they appeared to measure.

Reading Comprehension. A test of comprehension of rather technical passages. Primarily a measure of verbal comprehension, it also depended somewhat on mechanical experience and on general reasoning ability.

General Information—Navigator. An information or vocabulary test dealing with the terminology of such fields as astronomy, trigonometry, and science. The common factor measured was one of verbal ability, though the content suggests that the test also reflects technical and quantitative academic leanings.

Mathematics. A test of knowledge of advanced arithmetic, algebra in large amount, and trigonometry to some extent. Performance appeared to depend upon a complex of factors, including numerical fluency, verbal comprehension, background in school mathematics, and general reasoning ability.

Arithmetic Reasoning. A test composed of arithmetic word-problems of the sort that are common in the subtests of both scholastic aptitude and school achievement batteries, but cast in terms of planes and aviation. Numerical fluency, general reasoning, and verbal comprehension were the main factors identified in this test.

The above four tests had rather substantial intercorrelations, and appeared to form one cluster within the battery. In many of the analyses, these four tests have been pooled into a single composite score, which has been identified as a measure of a general intellectual, or scholastic aptitude, factor. This composite score is simply the equally-weighted combination of the above four tests.

Numerical Operations I and II. These were two scores, obtained separately for scoring convenience, representing speed and accuracy in simple numerical computations. Test I included addition and multiplication, Test II subtraction and division. These were nearly pure tests of numerical fluency.

Dial and Table Reading. The first part of this test required the subject to determine the numerical value represented by the reading on one of a set of airplane instrument dials, whereas the second part required him to locate entries in rather complex numerical tables. The test involved a number of ability factors, primarily numerical fluency, spatial relations, and perceptual speed.

The Dial and Table Reading Test and the two Numerical Operations Tests were combined into a second composite score. This was considered to be primarily an index of fluency in handling simple numerical materials.

Speed of Identification. This was a speeded test requiring the matching of visual forms. It was a rather pure measure of speed of visual perception.

Spatial Orientation I. This was also a perceptual matching test. In this case, small excerpts from aerial photographs had to be matched against locations in the complete photographs. Perceptual speed was again the chief factor involved.

Spatial Orientation II. This test required the matching of sections of aerial photographs with the locations on aerial maps corresponding to the photographs. Perceptual speed was again a major factor, together with some dependence upon spatial visualizing and on social studies background.

The three perceptual speed tests were pooled in a composite score that represents a perceptual, and possibly to some extent, a spatial factor. This is the third general factor represented in the battery of tests.

Mechanical Principles. This test was patterned closely after Bennett's Mechanical Principles Test, except that the items were cast in an aviation setting. Pictorial situations presented problems involving mechanical concepts and principles. Performance on this test depended primarily on factors of mechanical experience and of visualizing ability, but also to a slight degree on verbal comprehension and general reasoning.

Two-Hand Coordination. This was an individual apparatus test in which the examinee, by manipulating lathe-type controls, had to keep a pointer in contact with an irregularly moving target button. Performance on the test appeared to depend in part upon mechanical experience, in part upon spatial factors, and in part upon psychomotor coordination.

Biographical Data Blank—Pilot Key. The Biographical Data Blank was an assembly of questions about home and family background, school activities and successes, out-of-school activities and hobbies, work experience, and certain other items. The pilot key was an empirical keying of those items that were found to predict success in pilot training. The main factor represented in the pilot key was mechanical experience.

Scores from the Mechanical Principles Test, Two-Hand Coordination Test, and Pilot Key of the Biographical Data Blank were pooled to yield a composite score that was believed to represent primarily mechanical experience or ability. In the summary description of different occupational groups, this score provides one of the main components of the description.

Complex Coordination. This test was an individual apparatus one in which the examinee manipulated stick and rudder controls similar to those encountered in a light airplane. By moving the controls appropriately, he could match patterns of stimulus lights presented to him. His task was to match as many of the stimulus patterns as he could in a limited test period. The test appeared to measure primarily factors of spatial relations and psychomotor coordination.

Rotary Pursuit with Divided Attention. The subject's basic task was to keep a metal stylus resting on a target button that rotated on a 78 rpm phonograph turntable. At the same time, with the other hand, he had to depress the response button corresponding to one of two signal lights. The test appeared to measure psychomotor coordination as well as some type of spatial factor.

Finger Dexterity. This was a peg-turning test in which the subject was required to remove each of a series of square pegs from its hole, rotate it through 180°, and reinsert it. He was scored in terms of the number of pegs turned in a series of brief trials. Common factors measured by the test included psychomotor coordination and precision, visualizing, and possibly a little perceptual speed.

Aiming Stress. Basically, this was a test of hand steadiness, in which the subject had to keep a stylus pointer in a target hole without touching the edges of the hole. Verbal heckling was introduced in some trials to try to add an element of emotional stress. However, the only common factor appearing in this test was one of psychomotor coordination, so it should be thought of primarily as a motor test.

The four tests just described appeared to partake sufficiently of common motor factors and to correlate sufficiently to justify combining them into a single composite measure. This psychomotor composite constitutes the fifth and last of the pooled composite scores in terms of which summary occupational group profiles have been prepared. Additional tests, which were not included in any combination, are described below.

General Information—Pilot. This test was made up of a rather heterogeneous collection of information items selected because they appeared to have validity for predicting success in pilot training. These included items about planes and flying, auto driving, sports, and hobbies. The test appeared quite heterogeneous, and involved factors of pilot interest, verbal comprehension, mechanical experience, and perceptual speed.

Discrimination Reaction Time. This test was an individual test of speed of reaction. The reaction was to a pattern of visual stimuli, and the subject was required to choose the correct one of four response switches. Stimulus patterns were presented one after another, at about four second intervals, and the subject had to respond as rapidly as possible to each as it occurred. The test measured a complex of different factors, including spatial relations, psychomotor precision, perceptual speed, and visualizing.

Biographical Data Blank—Navigator Key. A second empirical key was established for the Biographical Data Blank, weighting those items that were found to predict success in navigator training. The key seemed to provide primarily a measure of extent of mathematical background.

In Part III of this volume, data are presented for each of the 20 test scores listed above for each of the 124 occupational groups identified in our population. However, in Chapter 3, we shall limit ourselves primarily to the five pooled composite scores, which can be thought of as representing approximately: I. general intellectual ability, or scholastic aptitude, II. numerical fluency, III. speed and accuracy of visual perception, IV. mechanical knowledge and experience, and V. psychomotor coordination.

The Biographical Data Blank, in addition to yielding the two scores described above, provided data on the responses of examinees to the separate items. Original answer sheets were available for the Biographical Data Blank, and item responses were transferred to IBM cards for each individual. Thus, information was available on some 112 distinct items on this instrument. Analyses of these item responses were carried out both in relation to occupational group membership and to job success.

FINDING THE MEN AND GETTING INFORMATION ABOUT THEM

The men in our sample had been given the battery of aptitude tests described above in 1943; we set out to find the men and get information about them in 1955, the search running on into 1956. Our problem was to reach as many as possible of an original group of 17,000 who were now scattered all over the United States, in fact all over the world, and with whom we had had no previous contact.

We were singularly fortunate in being able to enlist the cooperation of the Veterans Administration (VA) for this search. Most of the men *had* been in touch with the VA, either through having filed a claim of some sort, or through holding a National Service Life Insurance policy. The VA has an outstandingly efficient locator file that makes it possible to move from a man's name and Army Serial Number to the individual case record in a VA regional office or insurance center. Through these sources, as described more fully in Chapter 5, an initial address was obtained for each man. A brief questionnaire, held down with great care to one side of one sheet of paper, was sent to each man at the address provided by the VA. A card and two letter follow-ups were sent to those who had not already responded.

Perhaps a third of the original VA addresses proved to be out of date, with mail no longer being delivered there. Various military and civilian sources were used in order to develop a more up-to-date address for these cases. Resources included the Army Demobilized Personnel Records Center, the Air Force Reserve Records Center, and the Post Office Department's address list checking service. In addition, about 2000 of those who had failed to return questionnaires were followed by phone call, or personal visit in a small fraction of the cases, by representatives of the Retail Credit Company. The final disposition of our 17,000 cases was approximately as follows:

Questionnaire returned by respondent	51.3%
Information obtained through Retail Credit	7.1
Determined that respondent was on active duty in military service	8.1
Determined that individual was deceased	7.7
No response obtained, though address appeared to be correct	11.4
Individual lost, no acceptable address available when search was concluded	14.4

These percents can be combined in various ways, but one that appears to give a fair picture of our success in reaching the desired respondents is to put aside those in military service and those who were deceased, since neither of these were candidates for our present study, and to consider the number of completed cases as a percent of potential cases (completed plus nonrespondent and lost). If this is done, it appears that returns were obtained on almost 70% of the possible respondents. This percent could certainly have been increased somewhat further if we had had further time and funds to spend on the search. However, 70% return seemed rather satisfactory, and the pressure of time forced us to close our search at this point and to move ahead with organizing and analyzing the data.

Some effort was directed toward estimating the nature of the biases in our group of respondents, in comparison to the population from which they had been drawn. In terms of test scores, any differences between our respondents and the larger population from which they had been drawn seem negligible. However, in terms of occupation, it seems rather clear that the respondent group contains an excess of the more successful members of the original group and is deficient in representation of the failures. This is seen, on the one hand, in the lower occupational level of a group of cases that were tracked down only after a special search. It is seen, on the other hand, in the small number of unemployed individuals and the very small number of institutionalized cases that were identified among the men whom we managed to reach.

OCCUPATIONAL INFORMATION

The heart of the brief questionnaire that we sent to each man was a part devoted to getting information about his present occupation and his work history. Several other questions were included in the questionnaire, dealing with such things as postwar education, special licenses held, periods of postwar military duty, and so forth. However, this information was not used to any extent in the analyses that we have carried out. Our work has been based exclusively on the information that we obtained about each man's work experience. The questions asked were about the man's present job and his income from it, his feelings of success and satisfaction in his present work (rated very roughly on a four-point scale), his supervisory responsibilities, and the work history that had led up to the present job.

The most fundamental fact that was elicited by the questionnaire was the nature of the job in which the man was currently employed. Using the information supplied in the questionnaire, a coder assigned each man to the specific Dictionary of Occupational Titles code that best corresponded to the title and description that the man had provided for his current occupation. The number of different DOT codes represented among our approximately 10,000 respondents was, of course, very large. There were a good many hundred different specific titles that occurred in the group, many appearing no more than once or twice. A first step that was necessary before any analysis of the results could be carried out was to group the jobs into broader groupings and families, until the numbers in the separate groupings were sufficient to yield statistics with some degree of stability.

Grouping specific DOT titles into broader families was inevitably a judgmental process. The senior author's judgment was supplemented by that of two persons with a good deal of experience in occupations and occupational structure.* Grouping was fairly conventional, relying quite heavily upon the existing organization of the Dictionary of Occupational Titles. In some cases, it was possible to work with groups that were quite narrow and homogeneous. Thus, we had enough engineers among our respondents to permit us to keep separate six groups of engineers—chemical, civil, electrical, industrial, mechanical, and sales—and still have samples averaging over 100 for each of the specific groups. Here, our final occupational group corresponded to a single DOT code. In other cases, however, there were only one or two persons having a given DOT code, and it was necessary to merge a large number of specific codes in order to get a sample large enough to justify analysis. Thus, a loose grouping of "processing machine operators" included men in 20 or 30 specific DOT codes, all of whom were tenders or operators of some type of oven, mill, still, or other mechanism used in processing raw materials. This grouping had, therefore, relatively little unity or homogeneity. In other groups, a compromise was reached in which the homogeneity of the group was maintained at the expense of dealing with a much smaller N than would have been desirable. Thus, we report data for a group of only 14 undertakers. This is all the undertakers that we had available to us, and it did not seem desirable to try to merge this group with any other.

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*Professor Donald Super of Teachers College and Mr. Sidney Fine of the U. S. Employment Service.

In the end, we kept separate for analysis, and analyzed more or less completely, 124 different occupational groupings. These ranged from groups that were quite satisfactory in both homogeneity and size, such as a group of 235 accountants and auditors, down to groups that were either much too small or much too heterogeneous, or some of both.

The items on the questionnaire were also used to provide a number of rough indices of each man's success and satisfaction within his occupation. Seven criterion scores were devised from the information that the man provided:

(1) *Monthly earned income.* Each man was asked to report this, and most men did.

(2) *Number supervised.* This was thought to provide, at least for certain types of jobs, an indication of level of responsibility.

(3) *Self-rated success.* Each man rated himself on a four-point scale. The basis for rating was how well he felt he was doing relative to others in the same job.

(4) *Self-rated job satisfaction.* Each man rated his liking for his job, once again using a four-point scale of described categories.

(5) *Vertical mobility.* The coders who worked with a record made a rough judgment, in three categories, of how much upward progress a man showed in his complete work history, as reported to us. The rating was based on increases in job level, responsibility, and income.

(6) *Lateral mobility.* This was a rating by the coder of how much the man had jumped around from one type of work to another. The other end of the same dimension might be called occupational stability. The rating took account of the number and diversity of different occupations, rather than the number of different jobs within a single occupation.

(7) *Length of time in occupation.* This should hardly be considered a criterion measure. It was included primarily for any light it might throw on correlations of tests with other criterion measures.

The seven measures described above were crude and subject to a number of limitations. However, within the limits of a brief questionnaire they represented about as much as it seemed possible to get on level of success within an occupation. We subsequently correlated all test scores with each of these criterion measures for nearly 100 of our occupational groups. The smallest and most heterogeneous groups were omitted as not meriting this type of analysis.

The problem of evaluating occupational success for a population such as ours is an extraordinarily difficult one. The men were scattered over the whole country. It was a rarity to find two men doing the same kind of work for the same company. The nearest we came to it was a group of telephone installers, most of whom worked for the affiliated companies of the American Telephone and Telegraph Company. Even here, however, the men were spread over many different affiliates, widely scattered geographically. With the men so distributed, there is no fully satisfactory basis for comparison. Pay scales may vary from company to company and from region to region. It is not possible to obtain production records on any other objective indication of job performance that could be compared for the men in the group. There is no common basis for rating performance, even if it were administratively feasible to get such ratings. Our estimates of the relative success of different men in a group are, therefore, admittedly imperfect and fragile.

Monthly income is the index that seems most objective and that for many occupations seems the most relevant indicator of success. Income ceases to have much meaning if we try to make comparisons *between* occupations. On what grounds shall we say that the college professor making $600 a month is less successful than the contractor making $800? But within a single occupation, at least for many occupations, there would be agreement that as a first approximation, the man making the more money is the more successful man. However, we must recognize that the relationship is an imperfect one. There are variations of type and location of job even within a single occupation that attenuate the relationship, that is, in industry versus in civil service, in a big city versus in a small town. Inaccuracies of reporting income attenuate it still more. The impact of irrelevant factors, such as family ownership of the business, makes income even less trustworthy as a measure of true achievement. These considerations must be borne in mind as we examine the ability, or inability, of test scores to predict occupational success.

THE PROGRAM OF STATISTICAL ANALYSIS

Once the separate occupational groups had been identified, the first type of analysis was to determine the profile of mean test scores for each occupational group. The mean score was obtained for each group on each test. These raw score means were converted into standard scores. The standard scores were so defined that the mean of all 75,000 men tested with the July 1943 test battery was zero, and the standard deviation was 100. Thus, a score of +50 would represent a score one-half a standard deviation above the mean of Aviation Cadet applicants—the basic population of which our 17,000 cases were a sample.

It would have been possible to try to express the performance of our men with reference to a population defined as all men of their age group. Some evidence is available indicating the extent to which the prescreened Aviation Cadet applicants surpassed the general military population. However, these estimates are somewhat insecure, so that estimates in terms of general population parameters would have been only approximate. Furthermore, the results from this study may be useful primarily with high school seniors or graduates, and in this case the somewhat more select group of Aviation Cadet applicants may be a more meaningful one with which to make comparisons. The important thing to remember is that specific occupational groups are being compared to a reference population that surpasses men-in-general by as much as $1\frac{1}{4}$ to $1\frac{1}{2}$ standard deviations on some of the intellectual tests closely related to those on the basis of which the men were screened to perhaps as little as $\frac{3}{10}$ standard deviation on some of the simpler motor tasks. Thus, we estimate that the average accountant or auditor, who falls only $\frac{36}{100}$ of a standard deviation above the mean of our select group, falls 1.56 standard deviations above the mean of men-in-general. The nature of our special reference group must be kept clearly in mind as the reader attempts to interpret the test profiles.

The extensive prescreening in our group makes particularly difficult any interpretation of the profiles of groups in the less selective occupations. Thus, since our group was composed entirely of men who had passed a screening test at a score level about equal to that reached by the average high school senior, it is very unlikely that *any* of them had a level of intellectual ability too low to permit them to succeed as a truck driver, for example. The level of those who eventually became truck drivers should be expected to reflect primarily the indirect effect of selection by other occupations that tended to siphon off the more intellectually able, rather than any direct selectivity within the occupation of truck driver. This explains why truck drivers fall below average (−37) in reading comprehension in our sample. The more able readers among our men had become engineers, lawyers, or business executives. However, the estimate of our truck drivers' average reading comprehension in relation to that of the general population, where we find our group mean falling at +1.10 standard deviations, is essentially meaningless. The men are fairly obviously nonrepresentative truck drivers, and they scored as they did because our whole population was such a select one. Thus, our profiles must be interpreted with caution because (1) they are expressed with reference to a very select population and

(2) the samples in many occupational groups depend more upon the prescreening of the population and upon the indirect effects of selection by other occupations than they do upon any direct selective effects of the specific occupation being studied.

In spite of these limitations, however, we believe that many of the profiles are relevant and meaningful. This will be true especially for the groups that have exercised a positive selection within our sample —the professional and business jobs in the case of intellectual and numerical measures and some of the skilled trades in the case of the mechanical and possibly the psychomotor tests.

In the tables of Part III of this book, complete profiles are given for each occupation, showing the mean standard score for each of the 20 test scores that made up this particular battery. However, the test scores are not independent, and a number of them appear to measure somewhat the same factor. A factor analysis of the battery suggests that five factors can account for most of the common-factor variance of the tests. For this reason, groups of tests measuring to a considerable extent the same factor were pooled to give single "factor" scores. The pooling was an unweighted combination of three or four related tests, with the pooled scores rescaled so that each would still keep the same metric (i.e., mean = 0, standard deviation = 100). The nature of the factor scores is shown in the following tabulation, in which each has been given a designation and in which the tests entering into each are listed.

Title	Tests Included
General intellectual (possibly academic, or scholastic aptitude)	Reading Comprehension General Information-Navigator Arithmetic Reasoning Mathematics
Numerical	Numerical Operations I Numerical Operations II Dial and Table Reading
Perceptual-spatial (Visual perception, speed of perception)	Speed of Identification Spatial Orientation I Spatial Orientation II
Mechanical	Mechanical Principles Two-Hand Coordination Biographical Data-Pilot
Psychomotor	Complex Coordination Rotary Pursuit Finger Dexterity Aiming Stress

Discussion of the score profiles in Chapter 3 is based on these pooled scores, representing fairly broad areas of competence. Some detail is certainly lost in this pooling, and the person especially interested in a specific occupation should examine the complete profile in the appropriate chapter in Part III. However, the profile of pooled composite scores will be somewhat more stable, and its simplicity and minimum of duplication recommend it for use in the overview that we are trying to provide in this part of the book.

The profiles described above tell us, in terms of average scores, what each separate occupational group was like, and indicate peaks and hollows in the occupational pattern of scores. To get an indication of the extent to which tests predicted success within an occupation, we computed correlations between each test and each of the 7 criteria of success described as shown on page 16. This was done for about 90 occupations. With 20 predictors, 7 criterion measures, and 90 occupations, this represents some 12,000 validity coefficients. The computation of these statistics, and of the corresponding regression weights was made possible through the availability of modern electronic computing equipment.* The final conclusions that are drawn from this mass of data are somewhat discouraging, but these conclusions could not have been reached without the data. In spite of primarily negative results, we believe that the correlational analysis was a worthwhile and important part of the project.

As we have indicated earlier in this chapter, we had in addition to the test scores the actual item responses for each item of the Biographical Data Blank. Some items were Yes-No items and some were five-choice items, but for our analysis all were reduced to dichotomies. The response percentages for each item were determined both for our total respondent population and for each of the occupational groupings. The percentages for each occupational group were compared with those for the total group of respondents, and all differences significant at the 0.10, 0.05, and 0.01 level were noted. In the case of any occupation where the number of significant differences was greater than could have been accounted for by chance, tables were prepared showing the items that discriminated the occupation from our population of men in all occupations.

A further analysis of Biographical Data Blank items was carried out in which the men in a given occupation were divided into the upper and the lower half in terms of reported income. Percents choosing each response for each item were determined separately for the upper and lower group, and these were examined for significant differences. Such differences were occasionally found, but their number was no more than could be accounted for by chance. Our general conclusion was that the complete set of item differences could have arisen by chance, and that there was no real evidence that response to these items was predictive of job success as evidenced by reported income.

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*Assistance provided by the International Business Machines Corporation and the Educational Research Corporation made these analyses possible.

A final technique of analysis that was applied to a subset of 22 occupations was that of the multiple discriminant function.* Multiple discriminant analysis undertakes to determine the weighted combination of test scores that will most effectively discriminate among a set of groups. After one such combination has been found, further combinations may be sought, each independent of the first, that will in turn make the maximum residual discrimination. As many discriminants may be computed as the data appear to justify. Group means may then be located in the discriminant space, and the scatter of individual cases in this space may be determined.

For our sample of 22 occupations, four discriminants were identified. However, only the first two of these seemed to provide enough discrimination to justify their further analysis. Group means in the discriminant space have been determined, but no further analysis of this material has been undertaken.

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*This analysis was carried out by personnel of the Educational Research Corporation, Cambridge, Massachusetts, under the direction of Dr. Phillip J. Rulon.

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CHAPTER 3

The Results in Broad Outline

The results of our study were of two main types. In the first place we had information on differences among occupational groups. These differences were of two varieties. On the one hand we had differences in the level and pattern of test scores; on the other we had differences in response to items dealing with the personal history background of the individual. In addition to the data on differences among groups we had data on the extent to which the tests and biographical items predicted criteria of success within each of the groups.

In this chapter we shall present first the general findings with respect to the differences among groups in the level and pattern of test scores. These will be followed by some discussion of group differences in personal history background data. Finally, a section will be devoted to our results with respect to predicting criteria of success within specific occupations.

GROUP DIFFERENCES IN TEST SCORES

In this section we shall present the data that are available on group differences in test scores. We shall start out by taking a single occupa-

Table 3.1

Means and Standard Deviations of Test Scores for 235 Accountants and Auditors Expressed in Standard Score Units*

	Mean	Standard Deviation
Reading Comprehension	3	102
General Information—Navigator	20	86
Mathematics	29	96
Arithmetic Reasoning	36	110
Numerical Operations I	55	106
Numerical Operations II	48	104
Dial and Table Reading	31	102
Speed of Identification	−7	87
Spatial Orientation I	6	100
Spatial Orientation II	−9	105
Mechanical Principles	−37	102
General Information—Pilot	−31	98
Two-Hand Coordination	−11	109
Complex Coordination	−11	105
Rotary Pursuit	−8	96
Finger Dexterity	9	99
Aiming Stress	−32	114
Discrimination Reaction Time	9	105
Biographical Data—Pilot	−55	103
Biographical Data—Navigator	3	101

***Standard score scale has mean = 0, standard deviation = 100.**

tional group, accountants and auditors, and presenting the results for that particular occupation in some detail. These same types of information are available in later chapters for each of the occupations that we have studied. After that we will provide a table showing the means for each occupation on selected composite scores representing groups of the individual tests. Then we will go on to present a picture of the way in which the specific occupational groups are organized into families. Finally, we shall comment briefly on the two dimensions with respect to which the groups are most effectively differentiated, and see the grouping of occupations within that two-dimensional framework.

Let us turn our attention now to the group of accountants and auditors. This was a group of substantial size, consisting of 235 men working in these occupations. The complete set of test means and standard deviations, expressed in the standard scores that were used throughout the study, in which the mean for the total population was zero and the standard deviation was 100, is shown in Table 3.1. The highest scores for the group are on the two Numerical Operations Tests, on which the means are 55 and 48. Next in order are Arithmetic Reasoning and Dial and Table Reading. The group is also above average on Mathematics and General Information-Navigator. Lowest score (−55) is for the Biographical Data Blank-Pilot, and this is followed by Mechanical Principles. Both of these may be thought of as indices of mechanical knowledge and experience. The standard deviations for the accountants and auditors scatter on both sides of 100, the value for the population. Thus the spread of scores within the occupation is approximately the same as that in the total cadet population.

Table 3.2
Means and Standard Deviations on Composites of Related Tests, Expressed in Standard Score Units

Composite	Mean	Standard Deviation
General intellectual	28	98
Numerical fluency	54	104
Visual perception	−4	97
Mechanical	−46	105
Psychomotor	−16	104

Table 3.1 gives the complete results for this particular occupational group. However, it was our impression that the full set of 20 test scores was in some respects confusing. The tests correlate quite substantially in some cases, and the overlap of a number of related tests gives more detail than is entirely useful. In order to provide a more compact and a somewhat simplified presentation of the group profile, the tests were grouped and five composite scores were derived from them, as has been described in Chapter 2. The results for the accountants on these five composite scores are shown in Table 3.2 and represented graphically in Figure 3.1. The results of Table 3.2 confirm the essential features of Table 3.1, but the pattern comes out more simply and more clearly. Thus, we see that the accountants were a group that was substantially above our Aviation Cadet average in the numerical tests. They were also somewhat above this average in the tests of general intellectual or academic ability. They were about average in the perceptual tests, slightly below average in the psychomotor tests, and clearly well below the average for the group as a whole on the tests of mechanical ability.

Once again, though there were distinct differences in average level of performance on the different composites, it is also true that there was a wide range of variation within the group with respect to any one composite. That is, the standard deviation for these composite scores was as great within the occupational group as it was in the total population from which the group was drawn. Thus, we find certain individuals with relatively low numerical ability functioning as accountants and also, of course, individuals with high mechanical ability. The overlap is very marked, both between the different abilities within this one occupation and between different occupations with respect to the same ability. We would find, if we compared accountants and machinists, that there were some machinists with higher numerical ability than some of our accountants and some accountants with higher mechanical ability than some of the machinists. In thinking about our results and their implications for selection or guidance it is important to pay attention both to the differences between the means within a group and between groups, and to the overlap of groups or the large variability within a single occupation.

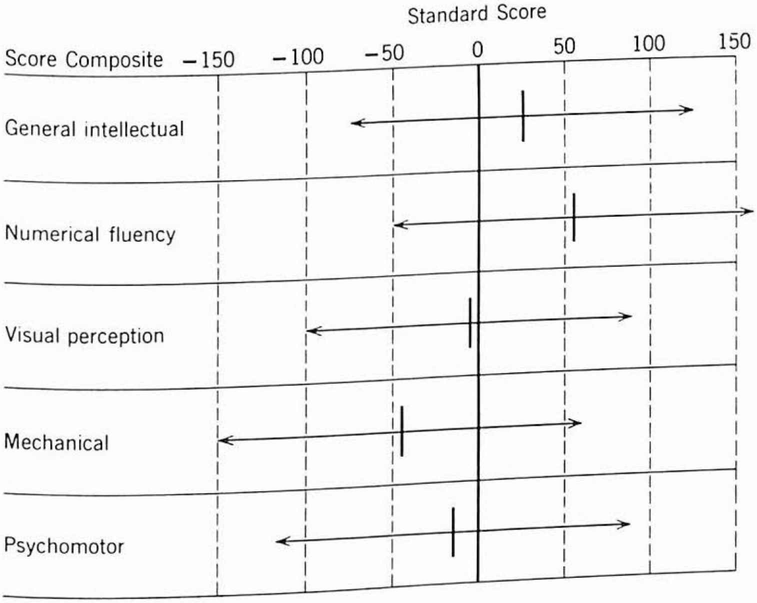

Figure 3.1 Score composite means and standard deviations for 235 accountants.

In Chapters 8 through 25 we have included tables corresponding to Tables 3.1 and 3.2 for each of the occupations for which we had data. In these tables we have shown the means for the separate test scores and for the score composites. However, we have not shown the standard deviations. It is generally true that the standard deviations for each occupational group are large and that the overlap between occupational groups is very substantial.

Our study included 124 occupational groups in all. The means for these 124 occupational groups on the five composite scores are shown in Table 3.3. This table can be thought of as representing the nucleus of the findings from the whole study. It includes the complete range of occupations. It gives the five main scores that represent the performance of the individual groups. More detail can be found in Chapters 8 through 25, and the individual who is interested in particular groups will do well to look them up and find the further information about them in the later chapters. However, the gist of the information about each of the 124 groups is given in Table 3.3.

A detailed examination of Table 3.3 will show that there are some occupations with very distinctive profiles. We have already seen the pattern for the accounts and auditors in which there is a difference of nine-tenths of a standard deviation between performance on the numerical composite and on the mechanical composite. As we look down the table we find a group of architects who are distinctively high on the tests of visual perception. A little further down the table we see a group of carpenters who are appreciably better on the mechanical composite than they are on the general intellectual tests. Still further down the table we come to a group of college professors who are highest on the general intellectual measures and well below average in their performance on the mechanical tests.

By contrast, there are some occupations that show relatively little irregularity in their test profiles. The clergymen, for example, are about average on all five of the test composites. In the same way, a group of dispatchers and control tower operators is a little bit above average on all composites excepting the academic. We find throughout the table a fair number of occupations in which the profile is quite flat and differences between test composites are much too small to be of any significance—either practical or statistical. Thus, the table suggests that there are some occupations that call for rather distinctive ability patterns and a number of others that have no very decisive or distinctive ability requirements.

In addition to the differences in pattern we can point out rather marked differences in level of performance on the tests. Thus, as we look at the test scores of the groups of engineers we find that they are typically above average on all of the test composites. Although there are some variations from one engineer group to another, most of them are higher on the general intellectual tests than on any of the others. Collectively, however, they represent a superior group in our sample of occupations. By contrast, the men in a group of production assemblers are clearly below average on all the test composites that we have avail-

Table 3.3

Occupational Group Means on Five Score Composites*

	General Intellectual (G)	Numerical Fluency (N)	Visual Perception (Ps)	Mechanical (M)	Psychomotor (Pm)
1. Accountants and auditors	28	54	−4	−46	−16
2. Advertising agents	26	−12	34	−15	−12
3. Agricultural, miscellaneous	13	10	−1	−16	18
4. Airplane pilots	−16	−20	18	64	43
5. Architects	44	4	74	8	14
6. Artists and designers	−7	−12	51	−4	8
7. Assemblers, production	−83	−76	−46	−27	−34
8. Bricklayers	−24	−5	−38	10	−32
9. Buyers	1	9	−18	−37	−18
10. Carpenters	−44	−17	−4	24	−1
11. Claim adjustors, insurance	−13	−5	−9	−44	−20
12. Clerical, accounting records	−28	5	−7	−48	−6
13. Clerical, communications	−30	4	−17	−19	−12
14. Clerical, machine operators	−30	−6	−1	4	−16
15. Clerical, material records	−36	−2	−14	−31	−6
16. Clerical, public contact	−1	2	−11	−29	−31
17. Clergymen	13	1	−17	−4	0
18. College professors	75	38	38	−33	1
19. Contractors	−7	−10	−10	34	5
20. Crane operators	−66	−84	−37	−19	−29
21. Dentists	28	20	15	−19	1
22. Dispatchers, control tower operators	4	37	31	31	41
23. Draftsmen	1	−14	31	14	15
24. Drivers, bus and truck	−53	−11	−23	−14	−20
25. Earth movers	−71	−70	−22	−3	−37
26. Electricians, structural wiring	−24	−20	−27	35	−3
27. Electricians, instruments and equipment	−33	−43	−12	17	7
28. Electricians, power systems	−30	−41	−33	22	−5
29. Engineers, chemical	106	42	30	19	20
30. Engineers, civil	75	31	56	36	14
31. Engineers, electrical	65	6	9	32	11
32. Engineers, industrial	44	41	34	−4	4
33. Engineers, mechanical	93	34	44	52	23
34. Engineers, sales	57	33	35	39	40
35. Engineers — trainmen, RR	−50	−37	−31	21	−1

*Expressed as standard scores for which mean = 0, standard deviation = 100.

Table 3.3 *(Continued)*

	General Intellectual	Numerical Fluency	Visual Perception	Mechanical	Psychomotor
	(G)	*(N)*	*(Ps)*	*(M)*	*(Pm)*
37. Farmers, specialized	-29	-32	-21	24	-35
36. Farmers, general	-6	-7	-29	38	-36
38. Firemen	-29	-29	-6	-10	15
39. Foremen	-30	-16	-17	8	-8
40. Guards	-52	-27	-83	-36	6
41. Handicraftsmen, jewelry, etc.	6	-4	15	26	5
42. Handicraftsmen, machinery	-12	-60	-36	-5	-17
43. Handicraftsmen, other	-45	-22	-17	-23	-9
44. Handicraftsmen, woodworking	-30	-29	0	35	1
45. Industrial relations specialists	45	25	22	5	11
46. Laboratory technicians, testers	-3	-8	4	2	5
47. Laborers	-33	-36	-13	-18	-24
48. Lawyers	39	22	-7	-42	-21
49. Linesmen, cablemen	-61	-42	-33	1	-22
50. Machinists	-35	-6	4	31	32
51. Machine shop specialists	-47	-45	-18	-3	-20
52. Machine operators, fabricating	-45	-25	-25	-39	9
53. Machine operators, processing	-51	-41	-56	-13	4
54. Managers, credit	-5	22	25	-27	0
55. Managers, directing production	19	1	17	22	3
56. Managers, financial institutions	6	33	-11	-33	-3
57. Managers, hotel, restaurant, bar	-51	-9	-18	-29	7
58. Managers, industrial and branch	11	20	-11	17	11
59. Managers, insurance	-6	19	-3	-35	-13
60. Managers, other	-2	-12	-10	-13	-35
61. Managers, office	4	33	9	-29	11
62. Managers, personnel	33	18	13	-20	-4
63. Managers, production	32	33	5	3	14
64. Managers, sales	-2	10	-4	-14	-6
65. Managers, service or recreation	-22	-1	-12	7	17

Table 3.3 *(Continued)*

	General Intellectual	Numerical Fluency	Visual Perception	Mechanical	Psychomotor
	(G)	*(N)*	*(Ps)*	*(M)*	*(Pm)*
66. Managers, transportation and warehousing	−7	24	4	−22	−18
67. Manufacturers' agents, brokers	−25	−8	8	−25	8
68. Mechanics, appliances and cameras	−19	9	17	32	54
69. Mechanics, engine	−28	−27	−29	28	−25
70. Mechanics, kilns, boilers, etc.	−34	−4	10	−1	24
71. Mechanics, machines and production equipment	−50	−37	−31	21	−1
72. Mechanics, office machines	49	1	33	35	36
73. Mechanics, vehicular	−72	−65	−7	19	−6
74. Medical, related and supporting	−8	−20	−19	−16	4
75. Miners, drillers	−43	−4	73	75	80
76. Officials, minor	−15	−17	−9	−18	−8
77. Optometrists	14	34	−3	−14	15
78. Painters	−63	−12	−24	−25	−22
79. Personal service, other	−49	−42	−25	−33	−29
80. Pharmacists	29	39	−9	−7	15
81. Physicians	59	20	18	2	0
82. Plasterers, cement finishers	−14	−12	−14	3	9
83. Plumbers	−42	−21	−31	−7	−5
84. Policemen, detectives	−50	−26	−20	−32	−4
85. Presidents, vice presidents and secretaries	40	20	15	6	20
86. Principals, high school	25	10	−13	−8	−24
87. Printing craftsmen	−55	−25	−18	−47	−19
88. Printing pressmen	−52	−31	−14	28	28
89. Public relations men	9	0	−4	−32	−9
90. Pumpmen and related	−55	−24	−17	−11	13
91. Purchasing agents	−8	20	12	−24	0
92. Radio and TV repairmen	−33	−37	21	2	5
93. Retail store owners, managers	−22	7	−10	−10	−9
94. Sales clerks	−40	−22	−28	−23	−3
95. Salesmen, insurance	−5	8	14	−17	2
96. Salesmen, real estate	6	17	6	−7	−9
97. Salesmen, securities	15	27	−20	−50	−32

Table 3.3 *(Continued)*

	General Intellectual	Numerical Fluency	Visual Perception	Mechanical	Psychomotor
	(G)	*(N)*	*(Ps)*	*(M)*	*(Pm)*
98. Salesmen, wholesale, chemical and pharmaceutical	5	22	11	−29	2
99. Salesmen, wholesale, clothes and dry goods	−13	23	0	−51	−9
100. Salesmen, wholesale, finance and transportation	5	25	−31	−29	−20
101. Salesmen, wholesale, food and beverages	−31	6	−20	−31	−28
102. Salesmen, wholesale, household hard goods	−21	−8	4	−15	−15
103. Salesmen, wholesale, industrial hard goods	−36	−12	−9	−5	−8
104. Salesmen, wholesale, publications and advertising	−15	−1	−8	−43	−17
105. Scientists, biological	33	12	25	−7	−21
106. Scientists, physical	80	22	23	5	−8
107. Scientists, social	64	33	21	−49	−26
108. Sheet-metal workers	−11	−55	−27	25	−24
109. Social and welfare workers	−8	−35	−40	−67	−34
110. Specifications writers, estimators	12	2	15	6	−3
111. Steel workers	−29	−37	−23	−8	−31
112. Surveyors	−25	−32	40	38	8
113. Teachers, elementary	−9	18	−27	−75	−32
114. Teachers, high school English, languages, social studies	−50	−37	−20	−102	−18
115. Teachers, high school mathematics and science	35	11	−4	−1	−2
116. Teachers, high school, other	−8	10	6	0	4
117. Telephone installers	−19	−20	5	5	−2
118. Treasurers and comptrollers	55	96	23	−31	5
119. Undertakers	−14	23	−35	−30	−12
120. Underwriters, insurance	3	2	−9	−31	10
121. Veterinarians	−8	−2	−20	−16	−5
122. Welders, lead burners	−61	−52	−32	−3	3
123. Wholesalers	−13	18	−4	−23	23
124. Writers	42	0	2	−50	−24

able for them. They tend to be further below average on the general intellectual composite. However, even on the tests of mechanical comprehension they do not come up to the average of the total group.

One further fact concerning Table 3.3 is worthy of mention. This has to do with the variability among occupations for the five different score composites. When we examine a distribution of the occupational group means for each of the five composites, we find that the intellectual and academic composite shows distinctly greater variation among groups than any of the others. The among-groups semi-interquartile range for this particular composite, expressed in our standard scores which have a standard deviation of 100 for individuals, is 23. The next most variable score composite is the mechanical composite with a semi-interquartile range of 18½. After that come numerical with 16½, visual perception with 15½, psychomotor with 12½. Part of the variation among groups in any one of these composites reflects the sampling idiosyncracies of our particular small samples, because many of the groups had quite small *N*'s. Therefore, we come to the conclusion that the genuine differences among occupations in the academic and intellectual composite were at least two to three times as great as those in the psychomotor test composite, and that the other three composites fall somewhere in between. This is perhaps not surprising in view of the educational and academic demands for entry into many of the professional and managerial occupations. The larger importance of this general intellectual component is certainly in part a function of these educational demands, though it may also be true that occupations do genuinely differ more in their demand for intellectual and verbal abilities than they do in their demand for the types of psychomotor skills that we were able to measure with our psychomotor tests.

In Table 3.3 we saw the occupational profile in terms of the five score composites for each of the 124 occupations for which we had data. It may be somewhat easier to see the families of occupations if we organize these results in a different way. In Table 3.4 we have organized the results in terms of the high point in the occupational test score profile. The procedure was to average the five composite scores for each occupation so as to establish a general base level of test performance for the occupation. Then any single score that extended as far as $^{15}/_{100}$ of a standard deviation above this average for the group was designated a "peak." If one or more of the five scores extended this far above, the group was identified as one having a peak in its occupational profile. If no one of the five extended this far above, the group was characterized as one having no peak in its occupational profile. For those groups that did have a peak in their occupational profile, the composite with the highest score served to define the peak and the classification of the group.

Table 3.4

Classification of Occupations by Type of Highest Ability and by Average Score Level over All Composites

High General Level	Medium General Level	Low General Level
	General Intellectual Peak	
College professors Dentists Engineers, chemical Engineers, civil Engineers, electrical Engineers, industrial Engineers, mechanical Engineers, sales Industrial relations specialists Manager, personnel Mechanics, office machines Physicians President, vice president, and secretary Scientists, biological *Ps*+ Scientists, physical Scientists, social *N*+ Teachers, high school, mathematics and science	Lawyers *N*+ Principals, high school Public relations men Writers	Social workers
	Numerical Fluency Peak	
Managers, office Managers, production Optometrists Pharmacists G+ Treasurers, comptrollers G+	Accountants, auditors G+ Buyers Clerical, public contact Manager, insurance Manager, financial institution Managers, transportation and warehouse Purchasing agent Retail store owners Salesmen, wholesale, clothes and dry goods Salesmen, wholesale, chemical and pharmaceutical	Clerical, accounting Clerical, material Clerical, communications Painters Teachers, elementary G+ Salesmen, wholesale, food and beverage Salesmen, wholesale, publicity and advertising

Table 3.4 *(Continued)*

High General Level		Medium General Level		Low General Level	
		Numerical Fluency Peak *(Continued)*			
		Salesmen, wholesale, finance and transportation	G+		
		Salesmen, securities	G+		
		Undertakers			
		Wholesalers			
		Visual Perception Peak			
Architects	G+	Advertising agents	G+	Printing craftsmen	
Artists, designers		Manager, credit	N+		
Draftsmen		Manufacturers' agent, broker	Pm+		
Surveyor	M+	Salesmen, wholesale, household hard goods			
		Radio, TV repairmen			
		Mechanical Peak			
Airplane pilot	Pm+	Carpenters		Assembler, production	Pm+
Handicrafts, jewelry		Contractors		Bricklayers	
		Electricians, structural wiring		Crane operators	Pm+
		Electricians, instruments and equipment	Pm+	Earth movers	Ps+
		Farmers, general		Electricians, power system	
		Foremen		Engineers and trainmen RR	Pm+
		Handicrafts, woodwork		Farmers, specialized	
		Printing pressmen	Pm+	Handicrafts, machinery	
				Linesmen, cablemen	
				Mechanics, engine	
				Mechanics, machines and production equipment	Pm+
				Machine shop specialists	
				Sheet metal workers	
				Mechanics, vehicular	Pm+ Ps+
				Steel workers	

Table 3.4 *(Continued)*

High General Level	Medium General Level	Low General Level
	Psychomotor Peak	
Mechanics, appliances and cameras	Firemen	Guards
Machinists *M+*	Mechanics, kilns, etc.	Manager, hotel, etc.
Miners, drillers *M+ Ps+*	Manager, service and recreation	Machine operator, fabricating
	Medical, related	Machine operator, processing
	Plasterers, cement finishers	Pumpmen and related
	Underwriters, insurance	Teachers, high school, English, etc. *Ps+*
		Plumbers
		Policemen
		Sales clerks
		Welders, lead burners M+
	No Peak	
Dispatcher, control tower operator	Agricultural, miscellaneous	Claim adjuster, insurance
Manager, directing production	Clergymen	Drivers, bus and truck
Manager, industry and branch	Clerical, machine operator	Handicraftsmen, miscellaneous
Specifications writer, estimator	Laboratory technician, tester	Laborers
	Managerial, miscellaneous	Personal service, miscellaneous
	Manager, sales	
	Officials, minor	
	Salesmen, wholesale, industrial hard goods	
	Teachers, high school, other	
	Telephone installers	
	Salesmen, insurance	
	Salesmen, real estate	
	Veterinarians	

In Table 3.4 the groups have been classified in terms of two considerations. Primarily they are classified in terms of the highest peak in the occupational profile. Thus, we have six groups consisting of occupations with peaks in the general intellectual, the numerical, the visual perception, the mechanical, the psychomotor, and occupations with no peak. Within each of these main groupings the occupations have been classified in terms of their average level of score on all the composites. Those occupations that fell in the top third of our total set of occupations in their average score on the five composites are called high, those that fell in the middle third of our set of occupations are called medium, and those that fell in the bottom third are called low occupations.

Thus, the table classifies occupations in terms of specific high points in their test profile and in terms of general level. Where an occupation had more than one high point in its test profile, the second and, in one or two instances, third high points are indicated by a code letter following the name of the occupation. Thus, in Table 3.4, our group of lawyers is classified as having a peak in the general intellectual tests so that they appear under the general intellectual heading. They are in the medium ability level group in terms of their over-all performance on the average of the five score composites, and the letter *N* indicates that they have a secondary peak on the numerical tests. Table 3.4 provides an organized summary of the way the jobs group themselves by level and by type of ability particularly required for the specific occupation. Thus, the group of occupations showing a high general level of test performance and a peak on the intellectual composite includes the occupations of engineer, college professor, physician. Lawyers, high school principals, public relations men, and writers show a peak on the intellectual composite also, but are only medium in average level on all test composites. Social and welfare workers are highest on the intellectual tests, but are low in general level of test performance. Occupations high in average level, but with a peak in the mechanical tests are airplane pilot and jeweler and watchmaker. Many skilled and semi-skilled occupations appear to be average or low in general level of test performance, but to have their highest level on the mechanical tests. The occupations falling in a given section of Table 3.4 can be thought of as forming a sort of job family in terms of test profile.

One further type of analysis was carried out to exhibit the differentiation among groups on the test scores. For 22 selected groups, largely those in the business and professional levels of occupations, a multiple discriminant analysis was carried out. The details of this analysis appear in Chapter 26. In general, the analysis tries to identify the combination of test scores that will most effectively discriminate among the 22 groups, and then tries to identify a second combination that will most effectively discriminate but be unrelated to the first one. Further combinations of test scores can be computed, but in this case only the first two seem to provide enough discrimination among groups to justify their use and interpretation.

The results of the multiple discriminant analysis for these 22 occupations led to two conclusions. In the first place, the tests unquestionably *do* discriminate among the occupations. The differences among them are statistically real. In the second place, the variation in score among men within the same occupation is large compared to the difference among occupations, even when the tests are weighted in such a way as to maximize the difference among occupations. The psychological nature of the two score composites that provide this maximum discrimination among occupations is not entirely clear. The first composite appears to define some kind of a quantitative intellectual dimension, differentiating those jobs with a higher demand in quantitative and mathematical knowledge from those with a lower demand in this dimension. The second seems to be a dimension that differentiates the mechanical from the verbal types of jobs.

The location of the 22 occupations on which this discriminant analysis was carried out in the two dimensional space can be seen in Figure 3.2. In the lower left-hand quadrant of this figure we find those occupations that are high in quantitative demand and that are mechanical rather than verbal in nature. This quadrant is not well occupied, but we do find the occupations of pilot, draftsman, and specifications writer in it.

In the lower right-hand quadrant are occupations high in quantitative demand and more verbal than mechanical. This quadrant is rather well filled, containing all the engineering specialties, physicians, physical scientists, company presidents, and lawyers.

The upper left-hand quadrant can be thought of as occupations more mechanical than verbal in demand and relatively low on the quantitative component. This quadrant is poorly represented in our set of 22 jobs. (Presumably the skilled trades jobs would have tended to fill this quadrant, if they had been included in the analysis.) The only occupations from the set of 22 that fall in this quadrant are hotel and restaurant managers, salesmen of industrial hard goods, and (just barely) retail store managers.

Finally, the upper right-hand quadrant represents those occupations relatively low on quantitative demand and more verbal than mechanical. This quadrant is represented by several occupations, but all are close to the coordinate axes. Occupations best representing this quadrant are office managers, sales managers, and a group of high school teachers of physical education, industrial arts, and various miscellaneous subjects.

This analysis provides one further way of identifying families of related jobs. The two dimensional space is a further abstraction from

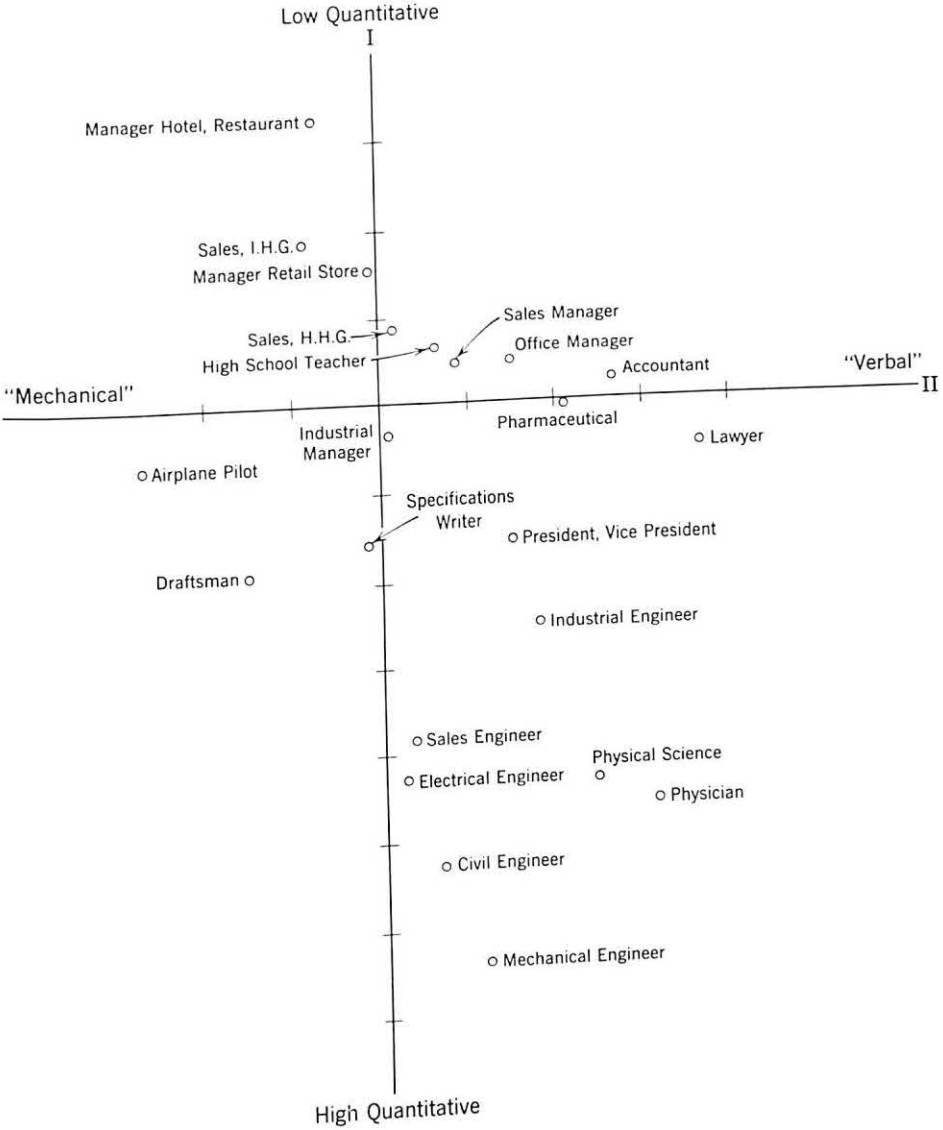

Figure 3.2 Location of occupational group means on first two discriminant axes.

our original 20 test scores and provides a compact and simplified framework within which we can see the differences among the occupational groups.

GROUP DIFFERENCES IN PERSONAL HISTORY BACKGROUND

As described in Chapter 2 we had available for each of the individuals in our sample responses to a Biographical Data Blank administered at the time the aptitude tests were given. This blank elicited somewhat over 100 independent responses from the respondents, dealing with matters of family background, personal and family education, success in school, hobbies, sports, activities, work experiences, and other facts of personal history. The responses to each separate item on this blank were tallied for each of the occupational groups in our population. Base rates were determined for the population as a whole and then differences were identified between specific occupational groups and the population as a whole. Tabulations were made of those differences that were significant at the 0.01, 0.05 and 0.10 level, and in Chapters 8 through 25 tables are provided for specific occupations, indicating which items discriminated and in which direction. Our problem in this chapter is to summarize some of this voluminous material, giving a general impression of the way in which these items discriminated and the extent to which discrimination was possible on the basis of biographical background material.

We may say in general that the biographical items did tend to discriminate among occupational groups. We can examine this either from the point of view of the specific item or of the specific occupation. Let us first take a look at the items. Of the 112 items that were separately analyzed, there were 7 that differentiated at the 0.01 level of confidence for more than 20% of the occupational groups. There were an additional 20 that differentiated at the 0.01 level for between 10% and 19% of the occupational groups. (Almost all the items differentiated at the 0.01 level for more groups than the 1% that would be expected by chance.) Thus, if we consider the items item by item almost all show evidence of achieving some differentiation among the occupational groups in our sample. This is perhaps the more striking when we remember that there were a substantial fraction of the occupational groups in which the number of cases was no more than 15, or 20, or 25. For an item to differentiate at the 0.01 level with a group of this size, the percentage difference between the sample and the general population had to be around 25 or 30.

It is of some interest to determine the nature of those items that most frequently differentiated among occupational groups. The one item that by a large margin had the most differentiations was the item that asked whether the man had had some college education before he entered the Air Force. Another item that dealt with the same thing was one on which the man indicated whether he had had a college major. These items differentiated at the 0.01 level for about 50% of the occupational groups in our sample. It is perhaps not surprising that the one thing that was most critical in determining subsequent occupation was whether a man had entered college by the time he reached 18 to 26 years of age. However, it must be remembered that this held true for a group all of whom could later have gone to college under the G.I. bill at no cost to themselves.

Of the top seven items, three others dealt to some extent with education. One of these had to do with the education of the mother and inquired whether the mother had graduated from high school. Two had to do with participation or success in two specific academic studies, physics and trigonometry. One other of the top seven may be thought of as an indirect measure of educational or at least of cultural background. This was an inquiry as to the number of books in the home in which the individual grew up during his youth. The one remaining item of the top seven was mechanical in nature and inquired whether the individual had frequently adjusted a carburetor.

Items that were in the next group in terms of their frequency of discrimination were also, in a number of instances, those relating to the individual's education, his success in school with different kinds of subject matter, and the family background of the home in which he grew up. This next group of items included also a considerable number dealing with some type of mechanical activity, either as a work experience or as a free-time hobby experience. Other items that differentiated for quite a number of occupations were items dealing with participation in activities of a verbal and, to some extent, social nature. These included having made a speech, having organized a club entertainment, and having interviewed men for a job. The complete picture of the items that served to differentiate among occupations is presented in Table 3.5. This table shows for each of the items in the biographical inventory the number of occupations for which it differentiated at the 0.01, the 0.05, and 0.10 levels. Thus, the counselor interested in getting leads as to types of items dealing with biographical background that may be predictive of later occupational choice and occupational group membership can find cues here as to the types that will be most frequently differentiating.

Table 3.5

Number of Occupations Differentiated by Each Biographical Data Item at Three Significance Levels

	Significance Level		
	0.01	0.05	0.10
General Family and Personal Background			
Lived mostly in the city	19	9	9
Many books in the home	22	11	6
Many tools in the home	11	6	11
Had some college education	54	10	6
Father graduated from high school	14	20	11
Father of American stock	4	9	11
Mother graduated from high school	23	12	7
Mother of American stock	2	11	9
Parents strongly favored joining Air Force	2	6	4
Duration of interest in aviation career	6	9	6
Family owned expensive car	14	12	10
Is a good safe driver	2	4	6
Has driven or ridden motorcycle	9	6	12
Family or close friend has been a pilot	5	7	7
Major Subject in College			
Did not attend college	46	17	6
Foreign languages	0	1	1
Social sciences or philosophy	14	10	9
Education	4	1	4
Business, commerce, journalism	13	9	11
Industrial arts, physical education, agriculture	6	2	5
Biological science, medicine	6	6	8
Physical science, mathematics, engineering	14	13	14
School Subjects Studied and Done Well			
Algebra	19	6	6
Dramatics	11	12	8
Economics	9	14	8
English	14	12	5
Foreign languages	10	13	6
History	12	4	8
Mechanical drawing	17	16	6
Music	2	6	6
Physical training	2	5	10
Physics	14	13	4
Public speaking	20	12	8
Shop work	18	18	7
Trigonometry	26	18	4

Table 3.5 *(Continued)*

	Significance Level		
	0.01	0.05	0.10
Sports Participated in and Done Well			
Football, rugby, soccer	5	7	3
Basketball, hockey, lacrosse	2	5	5
Baseball, softball	2	6	6
Boxing, wrestling, water polo	4	6	10
Crew, rowing, canoeing	6	7	10
Tennis, handball, ping-pong, badminton	9	12	10
Diving, ski jumping	1	9	1
Marksmanship	6	6	8
Sailboating	6	3	6
Auto, motorcycle, motorboat racing	4	5	6
Swimming	6	5	6
Track (dashes, hurdles)	2	4	7
Track (longer races)	4	8	7
Track (field events)	4	2	4
Horsemanship	6	10	5
Activities Done a Number of Times			
Adjust clock	2	5	6
Sell article to customer	10	6	9
Write technical report	13	10	6
Arrange club entertainment	18	14	8
Write essay or poem	11	11	6
Interview men for job	6	8	8
Arrange flower garden	5	8	5
Repair radio set	5	3	8
Solicit for a charity	3	1	6
Make a speech	17	15	8
Adjust carburetor	26	6	11
Hobbies and Free Time Activities			
Amusements (dancing, movies)	6	6	8
Painting, sketching	4	6	5
Music	2	11	5
Collecting (stamps, etc.)	3	14	6
Dramatics	7	10	14
Creative writing	12	6	6
Journalism, school paper	18	12	11
Boy Scouts	7	3	11
Photography	2	5	7
Amateur motion pictures	4	6	4
Woodworking, cabinetmaking	7	6	9

Table 3.5 *(Continued)*

	Significance Level		
	0.01	0.05	0.10
Sheet metal work	10	6	7
Metal work, machine shop	15	11	10
Auto repair, rebuilding	18	10	14
Build nonflying plane models	4	7	5
Build powered model plane	14	10	6
Participate in model plane contest	5	10	7
Work on glider or plane	4	6	4
Work Experience			
Unskilled manual	5	7	7
Semi-skilled manual	3	3	5
Skilled manual	16	17	13
Minor supervisory	4	11	6
Engineering, drafting, surveying	12	7	9
Simple clerical	14	17	9
Higher office work	13	5	6
Sales clerk, canvasser	9	18	5
Sales — auto, real estate, etc.	7	6	6
Managerial	6	4	10
Academic	6	6	14
Scientific	5	2	2
Instructor or leader	9	11	14
Semi-professional	4	2	3
Reporter, lawyer, advertising	4	3	7
Personal service	5	7	10
Entertainer	7	6	6
Protective service	2	4	5
Social service	1	0	2
No work experience	6	8	4
Reason for Choosing Cadet Training			
Love of adventure	4	5	10
Best way to serve	2	2	5
Feel have aptitude	2	6	7
Prefer duties to other branches	1	5	7
Better pay than other branches	1	5	3
To use training after war	0	8	3
Persuaded by others	0	0	0
To get away from home	0	2	1
Just suddenly decided	0	0	0
To prove can make good	6	7	6

Our discussion of the biographical items so far has been concerned primarily with identifying the items that differentiated most frequently and most sharply. Let us turn now to a consideration of the occupations for which particular types of items differentiated. Here we have such a large mass of detail that it is difficult to present any of it in a summary statement. The only way in which a really adequate picture of the results can be obtained is by going to the tables in the individual chapters and seeing which items did, in fact, differentiate for which occupations. By way of summary we can only say that the differentiations were generally sensible and in the direction one would have anticipated. Thus, we find that the individuals who were currently engaged in various types of skilled trades showed in their biographical background a history of having done relatively poorly on academic work in school, of having taken shop work and mechanical drawing, of having engaged in mechanical hobbies and free-time activities, of having worked at skilled trades prior to their entry into the Air Force more often than the general population. By contrast those in sales and managerial work were likely to have participated previously in work of this type, were likely to have engaged in activities involving interpersonal exchange such as making speeches, interviewing men for a job, setting up a club entertainment. Individuals in professional activities were likely to have done well in school and done well particularly in the more academic and intellectual types of courses. Where the intellectual activity in the job is verbal or numerical in character the groups were likely to be very low on their participation in activities of a mechanical nature. People in clerical occupations were likely to have had some background of clerical work and to have been conspicuously low in their participation in mechanical types of activities. In general, men in the higher level occupations were more likely to have been participants in social activities and group activities in school, whereas those in the lower level activities tended to have been less frequent participants. These are at best very general trends and the large amount of specific detail can only be seen by examining the tables for specific occupations.

RELATIONSHIP OF TEST SCORES AND BIOGRAPHICAL DATA ITEMS TO MEASURES OF SUCCESS WITHIN GROUPS

As we indicated in Chapter 2, we undertook to get for each individual a number of measures of success within the occupational group of which he was a member. The primary measure of success was, in most cases, reported income, but in addition we got the individual's report of his own satisfaction with his work and of his sense of success in it. We also rated his vertical progress and his stability within his occupation. Furthermore, information was obtained on the number of individuals whom he supervised and upon the length of time that he had spent in his present occupation. It is possible to correlate each of the test scores for a given occupational group with each of these measures of success. This was done for about 90 of the occupational groups. With the 20 test scores, 7 measures of success, and nearly 100 groups, there resulted some 12,000 correlation coefficients.

Evaluation of a mass of data of this kind is quite difficult, partly because a certain number of the correlation coefficients can be expected to be of good size purely because of the idiosyncracies of chance and sampling fluctuations within the sample. The question that we have to raise is whether the number of large correlation coefficients is significantly greater than would be expected by chance and whether the coefficients of substantial size appear with some consistency and are reasonable in their nature.

As a partial answer to this question, let us examine the correlation coefficients for one criterion, reported income, for a series of related occupations. The occupations we have chosen to present here are several different types of engineers. Correlation coefficients of the separate tests with income for these groups of engineers are shown in Table 3.6. Those correlations that are significant at the 0.05 level are marked with an asterisk.

An examination of Table 3.6 shows that the correlations are generally low. Only 16 of the 100 correlations are significant at the 0.05 level. What is perhaps more indicative is that only one test shows correlations significant at the 0.05 level for more than two of the five groups and none is significant for all the groups. There appears to be rather little consistency from one group of engineers to another in the tests that show the highest validity. Of course, it is possible that these different engineering specialties differ enough so that different tests should be expected to be valid for them. However, our first expectation would be that the same tests should in general be valid for different types of specialties within the field of engineering. This appears not to be true.

We would further expect that if a certain test were most valid, related tests should show similar validities and a composite made up of the related tests might be more valid than any of them taken singly. We have determined the validity of the five score composites for the five engineering specialties, and these are shown in Table 3.7. In general,

Table 3.6

Correlation of Test Scores with Reported Income for Five Groups of Engineers

	Chemical	Civil	Industrial	Mechanical	Sales
Reading Comprehension	09	23*	15	13*	10
General Information — Navigator	−03	13	18*	10	12
Mathematics	07	11	28*	16*	16
Arithmetic Reasoning	02	20*	22*	10	00
Numerical Operations I	19	08	12	05	12
Numerical Operations II	12	18*	13	06	10
Dial and Table Reading	18	19*	16	09	−05
Speed of Identification	22*	05	05	10	−02
Spatial Orientation I	07	17	01	14*	−08
Spatial Orientation II	−13	21*	07	16*	−12
Mechanical Principles	13	03	07	−02	01
General Information — Pilot	06	−01	06	06	−03
Two-Hand Coordination	14	11	−01	−08	03
Complex Coordination	02	11	01	−04	−09
Rotary Pursuit	12	10	−07	−01	10
Finger Dexterity	09	10	02	−02	−14
Aiming Stress	00	10	00	10	−07
Discrimination Reaction Time	09	18*	−05	05	02
Biographical Data — Pilot	11	06	06	04	02
Biographical Data — Navigator	00	02	18*	14*	19*

***Significant at the 0.05 level.**

we do not find larger correlations for the composites than for the single tests. The median value is about 0.10 in each case. It is true that 6 of the 25 correlations for composites are significant at the 0.05 level, and that this is more than would be expected as chance deviations from a population value of zero. However, of 385 correlations for 77 other occupational groups only 24, or 6.2%, reached the 0.05 level of significance. When we picked the five groups of engineers, we picked groups that showed more promising results than almost any others. The most reasonable interpretation of the complete set of validity coefficients that we obtained seems to be that they are chance deviations from a population value of zero. The null hypothesis (i.e., the hypothesis of zero validity) seems adequate to account for our results.

Table 3.7
Correlation of Composite Scores with Reported Income for Five Groups of Engineers

	Chemical	Civil	Industrial	Mechanical	Sales
General intellectual	05	22*	27*	16*	12
Numerical	20	18*	16	08	07
Perceptual	07	19*	06	17*	−10
Mechanical	17	09	05	−03	03
Psychomotor	09	15	−02	01	−08

***Significant at the 0.05 level.**

Data were also obtained on the validity of the single items of the Biographical Data Blank against the criterion of income in each of the occupational groups. Each occupational group was divided into an upper and a lower half in terms of reported income. The percentages responding in a given way on a particular Biographical Data Blank item was determined for the upper and the lower half and these percentages were tested for significant differences. Once again, the number of significant differences was not appreciably greater than would be expected by chance. Of course, for any given occupational group a certain number of items did display percentages that were significantly different. However, with 112 item responses to be tabulated and over 100 groups for which they are to be tabulated, inevitably we get a substantial number of statistically significant differences appearing only as a matter of chance. For these data again the best general conclusion seems to be that the responses to the Biographical Data Blank items were not related to income in the occupation as this was reported to us.

At this point we feel constrained to inquire why the validities turned out to be as discouraging as they were in this study. It must be admitted that there were a number of factors working against our obtaining significant validity coefficients either for tests or for single Biographical Data Blank items.

In the first place, there is the problem of the criterion measure. The measure that we were most enthusiastic about was reported income. However, it must be recognized that even within a relatively homogeneous occupational group there are many factors entering into the income of an individual other than his own competence. One has to do with the part of the country in which he works. Income in many occupations is probably higher in the large cities than it is in the rural areas. Income is probably higher in certain sections of the country, such as in the Northeast and the far West than it is in other sections. Another consideration is the type of employer for whom the individual works. Income is probably higher for those who have elected to work for a private company than for those who have elected to work in civil service or for a nonprofit organization. Factors of personal contacts and personal influence undoubtedly entered in some cases to affect the pay that an individual was able to get. Furthermore, there was an appreciable element of sheer chance determining the job that happened to be available at the time that the person was looking for employment and the employer with whom he happened originally to make contact. The individual's own ratings of success and satisfaction may be more a reflection of his personality than of his actual performance on the job. Our attempts to rate vocational progress were based upon meager information and may have missed a number of significant components of job performance. All in all, we must recognize that our criterion measures were imperfect and, in many cases, unreliable and influenced by factors of various sorts outside of those relating to the competence of the individual worker.

We must also recognize that our predictors were limited to tests of abilities. The range of abilities tested was considerable, including most of those that appear in civilian aptitude test batteries. However, although the Biographical Data Blank items did get at some of the components of personal background, most aspects of personality, temperament, interest, social skills, and the like were represented imperfectly, if at all, in the measures that were available to us.

A further point that should be borne in mind is that for any given occupation it is probably true that there are only a minority of tests for which we should *expect* significant correlations. That is, among our 12,000 correlation coefficients we should have expected a large proportion to be not significantly different from zero. Taking our data it is difficult to sort out the few significant tests from the others for which no special correlation should have been predicted. This makes it difficult for us to evaluate the relatively small proportion that do show up as significant. However, it must be admitted that when we did attempt to make a priori judgments of the tests that would be expected to predict and then did check these against the actual correlation coefficients, there was no appreciable evidence that the tests selected a priori gave higher predictions than those that we would not have so chosen. The problem of sorting out a posteriori those relationships that are significant from those that are fortuitous is an extremely difficult one and one that makes the type of enterprise in which we engaged in this study somewhat unsatisfying. If our correlational results had looked a little more promising, we would have undertaken to get a group of competent personnel psychologists to make predictions as to which tests would have had validity for specific jobs, and would have checked our obtained validity coefficients against these predictions. However, the general level of correlations was so low and the lack of consistency, as indicated in our data of Tables 3.6 and 3.7, so marked that it hardly seemed worthwhile to ask busy people to undertake to make predictions of this sort. In general conclusion, we must say that though it is *possible* that tests of aptitude can show validity in long-range predictions of occupational success when individuals are employed in jobs in widely different specific companies and settings in widely different parts of the country, our data give little evidence to encourage this belief.

GENERAL SUMMARIZING STATEMENT

What, then, can we say about the results of our study in broad perspective? Let us start by recognizing that the study has a number of limitations which make it less than perfect as a definitive study of the effectiveness of aptitudes as predictors of long-range occupational choice or success. The first of these limitations has to do with the sample of individuals whom we followed up. The group was a group that had been prescreened on the basis of a measure of aptitude as well as their self-selection of Aviation Cadet training. They represented roughly the top half of a high school graduating group, and so the lower level individuals who would have been likely to have failed in many occupations had already been eliminated from our population. The group was somewhat further screened by the fact that only about 70% of the possible respondents did respond to the questionnaire that we sent them. We have evidence that this resulted in some further limitation with respect to the dimension of occupational success. The indications are that the less successful individuals tended not to respond to our inquiry.

A second limitation lies in the scope of our test battery. The tests were tests of aptitudes and not of temperament, personality, or interests. Within the field of aptitude tests the battery was fairly comprehensive and covered most of the main types of aptitudes that we would see in a guidance battery in use at the present time. From this point of view, if aptitude tests are likely to give significant correlations with success we would have expected such correlations to have emerged for the tests in our battery. However, insofar as predictions are dependent upon matters of temperament and interest we would certainly not have caught them.

A third limitation lies in the heterogeneity of some of the occupational groups with which we had to deal. The men in even a nominally homogeneous group, such as a group of accountants or a group of lawyers, may be engaged in quite widely different activities as they operate in different companies and with different specific types of responsibilities. However, in a number of our less skilled occupations it was necessary to include individuals from a very wide range of specific DOT's in the same occupational grouping in order to get a sufficient number of cases to make statistical analysis have some meaning. We were at all points facing a compromise between obtaining groups of adequate size and those of maximum homogeneity. The outcome of this compromise was less than perfect in most instances.

A fourth limitation has to do with the criterion measures of occupational success. We have already discussed these at some length in previous sections and can only emphasize again that we were forced to rely upon the information that could be rather simply obtained in a brief questionnaire from the men themselves. It is possible that if we had been able to invest a very considerable amount of money in trying to obtain more detailed information from each employer, we could have developed a criterion measure substantially better than those that were available to us and that some appreciable prediction would have been obtained. We are not now highly optimistic about this possibility, but it must be recognized that the results must be interpreted in terms of our available criterion measures.

When it comes to differences between groups, our results show that these were real, sometimes substantial and, in most cases, sensible. That is, most of the group patterns and profiles were consistent with what our a priori predictions would have been. Occupational groups varied quite markedly in the unevenness of the profile they showed and this again is a reasonable finding. We found some occupations that seemed to be quite highly specialized in the aptitudes they called for and others that were much more generalized and seemed to have no very special aptitude requirements. While recognizing the real, sizable, and in most cases, sensible differences between groups, we must also recognize that the variability within any given group with respect to any given aptitude dimension was quite marked. It is easy to overemphasize the between-group differences. For individuals already as able and select as the ones with whom we had to deal there were probably no absolutely disqualifying limitations in the aptitude dimensions. At most, the lower level of aptitude was a predisposing factor, predisposing the individual not to get safely through the training for an occupation or not to try to enter it.

Our results showed that occupational groups differed with respect to personal background variables as well as with respect to aptitude test scores. It is hard to make a quantitative comparison between these two types of information, but our judgment would be that items of personal background differentiated about as sharply as did scores on aptitude tests. Once again, the patterns were, in most instances, sensible and in accord with what we would have expected by an a priori analysis of the occupations. It is possible to rationalize most of the significant differences with some satisfaction. There were, of course, some differences that are difficult to rationalize, but these can, in many instances, be thought of as chance variations and ones that probably would not hold up in another sample.

With respect to prediction of success within an occupation, our conclusions must be quite different. As far as we were able to determine from our data, there is no convincing evidence that aptitude tests or biographical information of the type that was available to us can predict degree of success within an occupation insofar as this is represented in the criterion measures that we were able to obtain. This would suggest that we should view the long-range prediction of occupational success by aptitude tests with a good deal of skepticism and take a very restrained view as to how much can be accomplished in this direction. It is possible that data for a more heterogeneous group of applicants would lead to different conclusions in this respect; however, our suspicion is that if the group had been more heterogeneous, our increased success would have shown up primarily in an increased sharpness of differentiation among occupations rather than in improved ability to predict within a single occupation. Certainly, if we had taken the whole range of abilities in the American population, the profile patterns would have become very much more clear-cut and the differences among occupations would have become a good deal more striking. Whether at the same time we would have developed some success at predicting degrees of achievement within an occupation seems very much open to question.

PART II

CHAPTER 4

Nature of the Aviation Cadet Population and of the Aircrew Aptitude Test Battery

Our investigation was based on the tests administered to applicants for Aviation Cadet status in the Army Air Force in World War II. It is necessary, therefore, that we become informed about the population of Aviation Cadet applicants, the sample of cases drawn from that population, and the battery of tests administered to these men. In this chapter we will first of all describe the population, indicating the way in which men became applicants for Aviation Cadet training, some of the gross descriptive features of the population, and some estimates of the test parameters for cadet applicants in relation to the general population of the same age. We shall then describe the manner in which the sample for the present study was chosen. Finally, we will describe in some detail each of the test scores that were available for these men, showing illustrative test items in many cases, and giving the factor loadings that have been found in analyses of the tests.

THE BASIC POPULATION

The men who became Aviation Cadets in the Army Air Force during World War II were all volunteers. Thus, our population was initially screened by whatever combination of factors led men to volunteer for Aviation Cadet training. The selective factors that operated at this point cannot be identified with confidence. However, the following are suggested as probably having operated in some degree:

(1) An adventurous spirit and willingness to undertake the somewhat hazardous activities of flying.

(2) Liking for mechanical devices and activities involving things rather than people.

(3) An expectation that one would be able to pass the physical and psychological tests set as requirements for admission.

(4) Willingness to assume the responsibility of officer status, i.e., a certain amount of upward striving.

There may have been some exclusion of those of highest academic aptitude, owing to their retention in universities or medical schools or to the competition of other officer training programs. Other elements of self-selection may also have operated in determining what types of men would apply. The points to be remembered are that these men, if they succeeded in the training, would be officers, fly planes, and be exempt from the demands of other types of military service.

For a man to be accepted as a candidate for Aviation Cadet status he had to qualify on several counts. Specifically, he had to

(1) be between 18 and 26 years of age,
(2) be unmarried,
(3) pass a fairly rigorous physical examination, and
(4) pass the Aviation Cadet Qualifying Examination.

From the point of view of our present study, the most significant of these requirements is the last.

The Aviation Cadet Qualifying Examination was introduced on 15 January 1942 as a substitute for an educational requirement that had previously been in effect. Up to that time, applicants for Aviation Cadet training had been required to have completed 2 years of college. As the tempo of participation in World War II increased, it became apparent that it would not be possible to meet personnel quotas in the Aviation Cadet training program entirely with college-trained personnel. The Qualifying Examination was initially introduced to guarantee an ability level equivalent to that of the prewar college-trained group, while eliminating the formal college requirement. As time went by, the character of the Qualifying Examination was changed somewhat, and it was made more nearly a paper-and-pencil pilot aptitude test. However, at the time that the men who became members of our research sample were recruited the test could be thought of as a measure of scholastic aptitude and achievement. Thus, the content outline for the first forms of the test was as follows:

General vocabulary	45 items
Reading comprehension	15 items
Contemporary affairs	30 items
Mechanical comprehension	15 items
Practical judgment	15 items
Mathematics	30 items

A minimum score was set on the Qualifying Examination, and only those men who were able to reach this score were accepted as applicants for cadet status and permitted to take the battery of classification tests described later in this chapter. Although minimum score levels were changed somewhat from time to time during the war, one would not be far off if one said the qualifying score was one that could be achieved by about half of high school graduates. Thus, the cutting score for our population on a composite measure of academic ability was probably equivalent to an I. Q. of at least 105, possibly higher. Clearly, the whole population of examinees had been sharply restricted with respect to scholastic ability. The men were drawn almost entirely from the top half of the United States population of the age group. All findings from the study must be interpreted in the light of this fact.

THE RESEARCH SAMPLE

Testing with uniform batteries of aircrew aptitude tests started in July 1942, and continued throughout the rest of World War II. During that time over 500,000 men were tested. Funds available for the present study were believed to be sufficient to permit following up approximately 15,000 of these men. The first problem in research strategy was that of deciding how these men should be chosen from the larger population.

The exact battery of tests used for aircrew testing was changed a number of times during the war. These changes were brought about by the availability of new tests, especially apparatus tests, by the accumulation of new data on test validities, and by changing military demands. For our study it seemed highly desirable that the test battery be uniform for all the men in the research sample. This uniformity seemed imperative for efficient analysis of the test data in relation to the information about educational and occupational careers. It was first necessary, therefore, to decide which battery was to be selected. This choice represented a compromise of values. On the one hand, the Air Force was interested in having an *early* battery used, because men who had entered the Air Force early in World War II would have been more likely to have continued on active duty after the end of World War II. (A subsidiary study being made from the basic data, but not reported in this volume, is a study of test scores in relation to the careers of Air Force officers.) On the other hand, it was desirable not to use the earliest batteries, because these were somewhat incomplete, lacking individual psychomotor tests in a number of cases, and because procedures for scoring tests and reporting data were not entirely uniform for the different testing stations. Considering these factors and reviewing the tests actually included in the batteries, the final decision was to select a sample tested with the battery that was introduced on 1 July 1943 and was in effect until December 1943.

During the 5 months that it was in use, the test battery of 1 July 1943 was administered to between 74,000 and 75,000 men. We resolved, therefore, to take a 20% sample of this population. Testing was done at this time at three centers—Nashville, Tennessee, San Antonio, Texas, and Santa Ana, California. The volume of testing at each center was nearly the same, so our sample was drawn equally from the men tested in each center. In this way, some control of geographical representation was provided. From the tests given in any center, blocks of 500 consecutive testing numbers were chosen. Eleven such blocks were chosen for each center, well spread over the range of testing numbers used during the 5-month period. Thus, though the sample was not a rigorous probability sample, one can be reasonably sure that in all essential respects it matched closely the total group of 75,000 men tested with the battery of 1 July 1943. Eleven blocks of 500 cases each gave 5500 men from each station, or a total of 16,500. However, the count was not exact and the initial roster finally turned out to be nearly 17,000. The excess over 15,000 was to allow for cases that could not be located in military records.

Some tables of summary statistics are available (2, p. 338) for groups tested at about this time that make it possible for us to estimate the age and education of the men in the sample. Entrance into aviation cadet training was limited to the age range 18 to 26, though somewhat older men could receive flying training if they were already officers. During the period covered in this study, the average age of men tested was approximately 21.2 years. The distribution was rather skewed and probably 75% were under 22 years of age. The group averaged slightly more than 12 years of education, and the modal education was undoubtedly high school graduation.

At the time the men in the sample used in the study entered the Air

Force, all recruits for Aviation Cadet training were required to pass the Aviation Cadet Qualifying Examination, in lieu of an educational requirement. Studies (1) indicated that the cutting score on this test fell somewhat above the average of twelfth-grade students. Thus, our sample may be thought of as having ability about typical of that in the upper half of a group of high school graduates.

THE TEST BATTERY

As indicated above, the final decision was to carry out our study on the battery of 1 July 1943. We shall need to refer to the tests in this battery repeatedly as we describe the test performance of different occupational groups. It is important, therefore, that the reader become well acquainted with these tests, so that they will have solid meaning for him as we refer to them. As recorded in the IBM cards for our cases, the battery yielded 20 separate scores. However, in two instances 2 scores were obtained from different groups of items in the same test, and in one instance 2 scores were really subscores of a single test.

The following pages give fairly detailed information about each of the tests. We have described them verbally. In most instances we have shown illustrative items or photographs of the test apparatus. All the tests have been included in several factor analyses, and the results have been summarized by Guilford and Lacey (3). We have reported the main factor loadings for each test as a part of our description.

Reading Comprehension. This was a conventional reading test pitched at a level about suitable for college undergraduates and based on rather technical material. It was made up of six passages dealing, respectively, with (1) power gun turrets, (2) airplane propellers, (3) the Mercator projection, (4) celestial navigation, (5) drift of projectiles, and (6) carburetor icing. There were five comprehension questions on each passage. Factor analyses of the test had indicated loadings as great as 0.20 of the following factors:

Factor Designation	Loading
Verbal comprehension	0.60
Mechanical experience	0.37
Reasoning ability	0.27
Visualizing-manipulating in space	0.24

When scored $R - \frac{1}{4}W$, the test gave a mean score for Aviation Cadet applicants* of 10.91 (out of a possible 30) and a standard deviation of

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*Based on the total group of more than 74,000 cases tested with the 1 July 1943 battery.

5.67. The test yielded an odd-even reliability coefficient of 0.76 in one sample of 480 cases.

Mathematics This test was designed to measure performance in advanced arithmetic, algebra, and trigonometry. Illustrations of the three sorts of items are shown below.

1. $17 - [5 - (7 - 9)] =$

   1-A. -4
   1-B. 10
   1-C. 14
   1-D. 18
   1-E. 28

2. If $bx - 3 = cx$, then $x =$

   2-A. $\frac{b}{c-3}$
   2-B. $b+3c$
   2-C. $\frac{b-3}{c}$
   2-D. $3b-c$
   2-E. $\frac{3}{b-c}$

3. The sine of 45° is

   3-A. $\frac{2}{\sqrt{2}}$
   3-B. 2
   3-C. $\frac{1}{\sqrt{2}}$
   3-D. $\sqrt{2}$
   3-E. 1

The factors that factor analysis studies brought out in this test were as follows:

Factor Designation	Loading
Numerical fluency	0.51
Verbal comprehension	0.37
Mathematics background	0.37
General reasoning	0.24

When scored $R - \frac{1}{4}W$, the mean score on the test for Aviation Cadet applicants was 11.46 (out of a possible 35) and the standard deviation was 8.26. Raw scores showed marked positive skewness. The reliability of this test appeared to be quite high, a coefficient of 0.92 being obtained for an earlier and quite similar version of mathematics test.

Arithmetic Reasoning. This test consisted of 30 arithmetic word-problems of the sort that are common in subtests of both scholastic aptitude and school achievement batteries. However, the problems were all cast in terms of planes and flying to give them some superficial face validity. An illustration of one of the easier problems is the following:

If a plane is to fly 132 miles in 45 minutes, what must be its average speed?

A. 146.7 mph
B. 164 mph
C. 165 mph
D. 176 mph
E. 182 mph

The factor loadings indicated in factor analyses of this test were as follows:

Numerical fluency	0.48
General reasoning	0.47
Verbal comprehension	0.27

When scored $R - \frac{1}{4}W$, this test was found to have a mean of 7.52 and a standard deviation of 4.70 in the group of Aviation Cadet applicants, and the distribution had distinct positive skewness. Studies indicated the reliability to be about 0.80.

Numerical Operations. This test measured speed and accuracy in performing simple arithmetical computations with whole numbers. The test was printed on two sides of a special IBM answer sheet. The front had 100 addition and multiplication problems in the three following patterns:

$$11 + 19 + 22 = 52 \qquad \begin{array}{r} 139 \\ \times\, 7 \\ \hline 973 \end{array} \qquad \begin{array}{r} 12 \\ 19 \\ 28 \\ \hline 59 \end{array}$$

The examinee had to indicate whether the answer was right or wrong in each case. The back of the answer sheet was made up of 80 subtraction and division problems of the types shown below:

$63 - 38 =$	25	21	29	32	26
$233 \div 7 =$	39	37	$33\frac{2}{7}$	$37\frac{2}{7}$	35
$\begin{array}{r} 93 \\ -58 \\ \hline \end{array}$	45	35	34	46	43

As illustrated, these problems were in multiple-choice form. For clerical convenience, the two sides of the answer sheet were scored separately and the two separate scores appear on each man's record card. However, they received identical weight in all prediction equations and were treated as a single measure.

The Numerical Operations Test was given with a short time limit, emphasizing speed, and was scored $R-3W$, thus placing a great premium on accuracy. The only factor loading of any size for the test scored in this way was on the factor of numerical fluency, and this loading was approximately 0.80. Reliability appeared to be about 0.70 for the front and 0.80 for the back of the answer sheet. (Front and back correlated 0.69 in one study.) Mean and standard deviation for the two sides of the sheet were as follows:

	Mean	S. D.
Front	37.21	12.36
Back	32.57	11.86

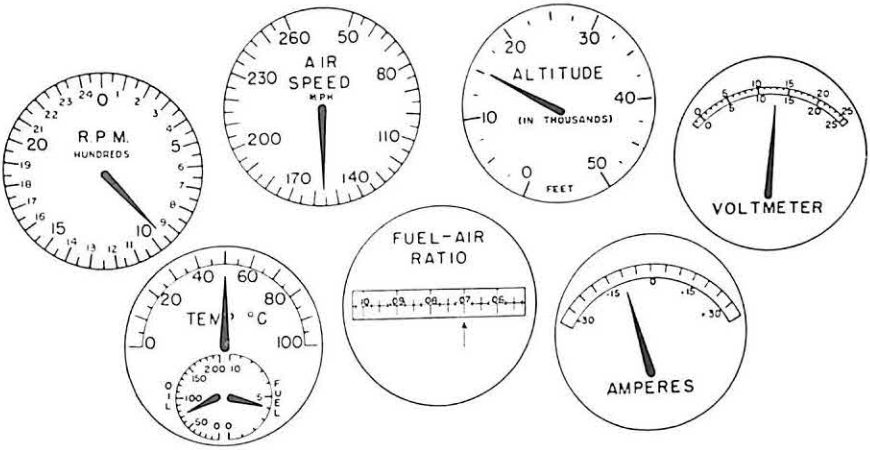
Dial and Table Reading. This test was really two subtests of somewhat related functions that were combined to yield a single score. The Dial Reading part required the examinee to read instrument dials such as he might meet in a plane cockpit. Printed on the test page was a bank of 7 dials, graduated in different units and with different degrees of detail. The examinee was given a series of problems based on each set of dials. Each problem required him to determine the correct reading for a specified one of the set of dials. A set of sample problems is shown in Figure 4.1.

The Table Reading Test had two sections. In the first the subject was required to locate values in a large double-entry table. The second section was made up of tables of rather complex construction involving five variables associated with the flight of an airplane. The problems specified three of the variables, and the examinee had to determine the correct value for one of the other two.

The test was given with rather short time limits, so that it was definitely speeded. A single score was recorded for the 57 scored items of the Dial Reading and the 86 scored items of the Table Reading Test. The test appeared to be a complex measure of a number of different factors, the loadings found in factor analytic studies being:

Numerical fluency	0.53
Spatial relations	0.42
Perceptual speed	0.31

Scored $(R-W)/2$, the test yielded a mean of 34.41 and a standard de-



Sample Problems:	A	B	C	D	E
I. R. P. M.	91.	89.5	9.5	92.	105.
II. Amperes	16.	−15.5	14.	−10.	−2.
III. Altitude	157.5	15.5	155	1.5	152.

Figure 4.1 Sample problems from Dial Reading Test.

viation of 8.90. The reliability of the test, as estimated from several sets of data, appears to be from 0.85 to 0.90.

Speed of Identification. This test was a simple one of matching perceptual forms. The forms, which were airplane silhouettes, were grouped in sets of four. The matching silhouettes, rotated through various angles, had to be selected from a second set of five. A sample set is shown in Figure 4.2. The test was given with a 4 minute time limit, and was primarily a speed test. The test seemed to be a fairly pure measure of a factor of perceptual speed. Its loading on this factor was 0.70, and it had no other loadings as large as 0.20.

The mean score for the test, scored $R-W$, was 33.38 (out of a possible 48) and the standard deviation was 7.25. Reliability, based on separately timed halves of the test, was found to be 0.76.

Spatial Orientation I (Aerial Photographs). In this test, the examinee had before him an aerial photograph of a section of terrain. He also had a number of small circular excerpts from the larger photograph. His task was to find the spot in the larger photograph corresponding to each of the little sections. A sample of the test material is shown in Figure 4.3. The test was given with a short time limit (5 minutes), and factor analyses indicate that it functioned primarily as a measure of perceptual speed. The loadings as large as 0.20 were:

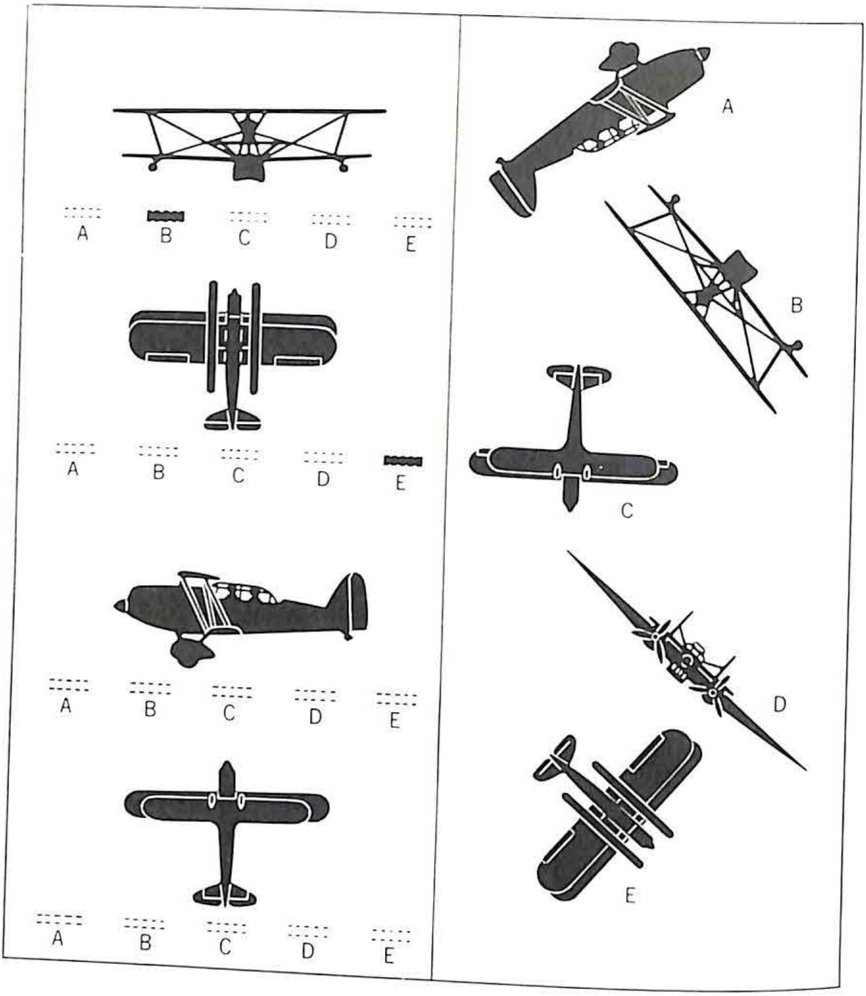


Figure 4.2 Sample problems from Speed of Identification Test.

Perceptual speed	0.62
Psychomotor speed	0.21
Visual memory	0.20

The test had 50 items and was scored $R-W/5$. It had a mean of 27.81 and a standard deviation of 5.63. A reliability study, based on testing 1090 men with separately timed halves of the test, indicated that it had a reliability of only 0.63.

Spatial Orientation II (Aerial Maps and Photographs). On each page of this test appeared a section of a standard aviation map printed in color. Below the map appeared a number of aerial photographs of small areas of the terrain covered by the map. The examinee had to find the location on the map that was shown in the photograph, and indicate on the answer sheet the section of the map in which the area was located. Black and white reproductions of a set of sample items are shown in Figure 4.4. The test was paced, allowing 3 minutes for each double page containing 2 maps and 8 test items. Given in this way the factor loadings were:

Perceptual speed	0.54
Visualizing (visual rearranging)	0.25
Social studies background	0.20

When the 48 item test was scored $R - W/5$, the mean score was 20.70 and the standard deviation 6.53. Reliability data were available only for a retest with the same test. For 712 cases retested after 30 days, a coefficient of 0.69 was obtained.

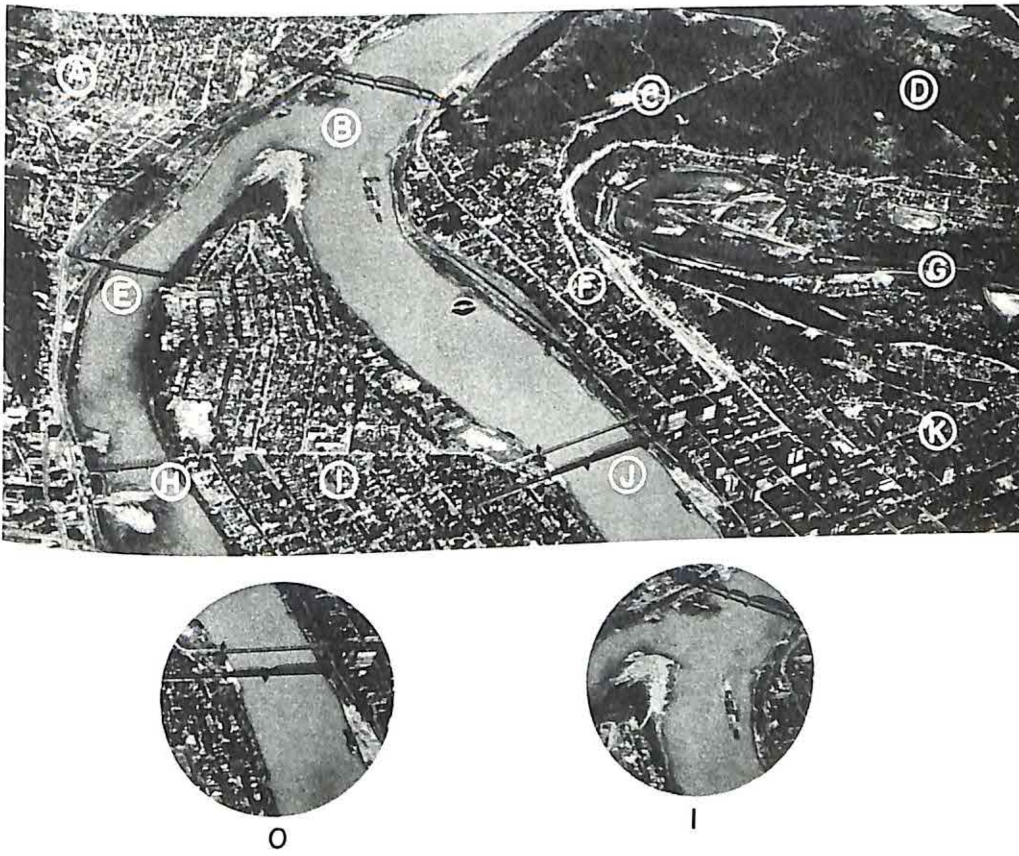
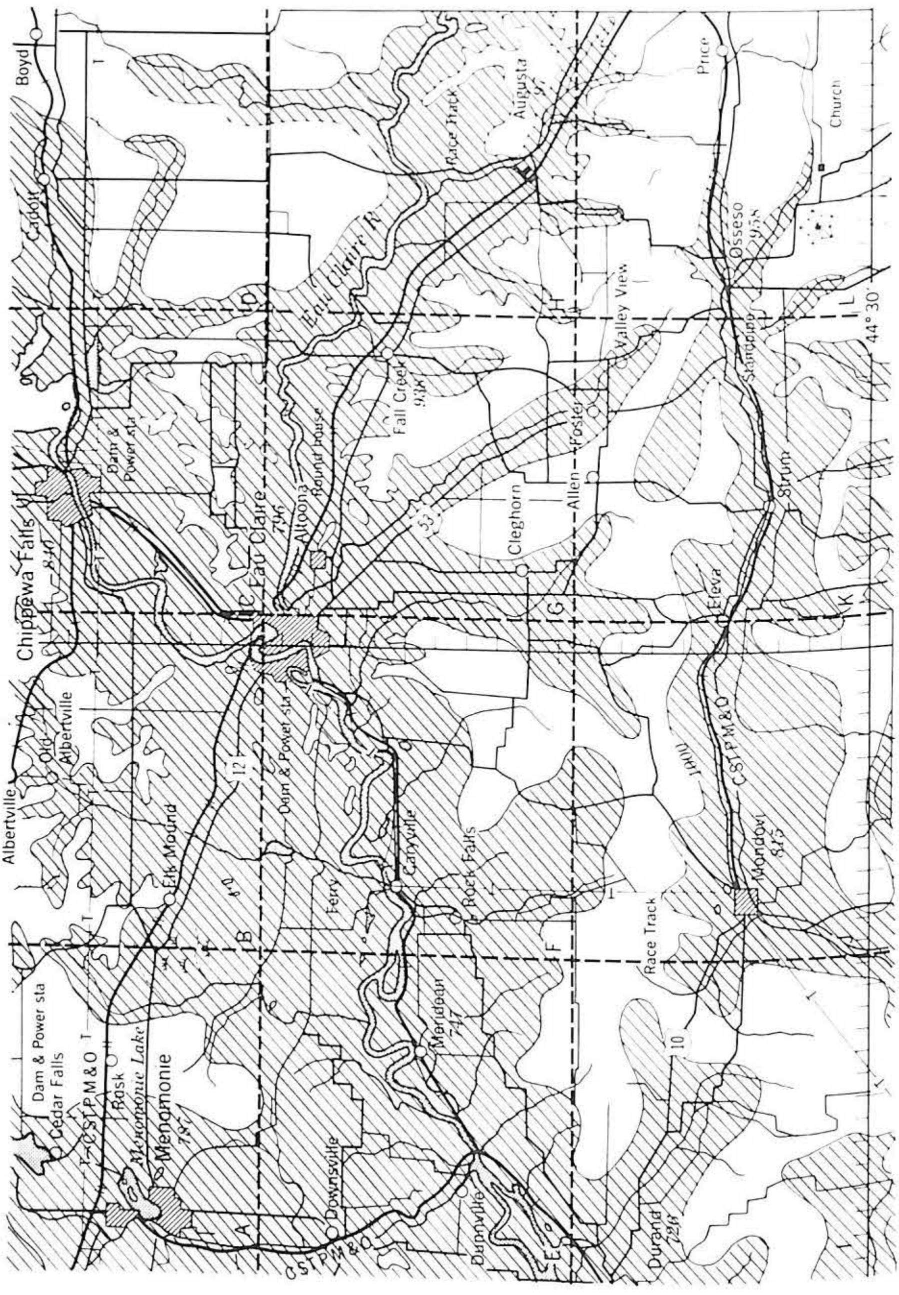


Figure 4.3 Sample problems from Spatial Orientation I.


Boyd
Cadott
Chippewa Falls
840
Albertville
Old Albertville
Dam & Power sta
Eau Claire
796
Altoona
Round house
Fall Creek
938
Eau Claire R
Race Track
Augusta
Price
Church
Osseso
958
Stanley
Valley View
Foster
Allen
Cleghorn
53
Strum
Eleva
CSTPM&O
1000
Mondovi
815
Race Track
Elk Mound
12
Dam & Power sta
Caryville
Rock Falls
Ferry
Meridean
747
Dam & Power sta
Cedar Falls
Rusk
Menomonie Lake
Menomonie
797
Downsville
Dunnville
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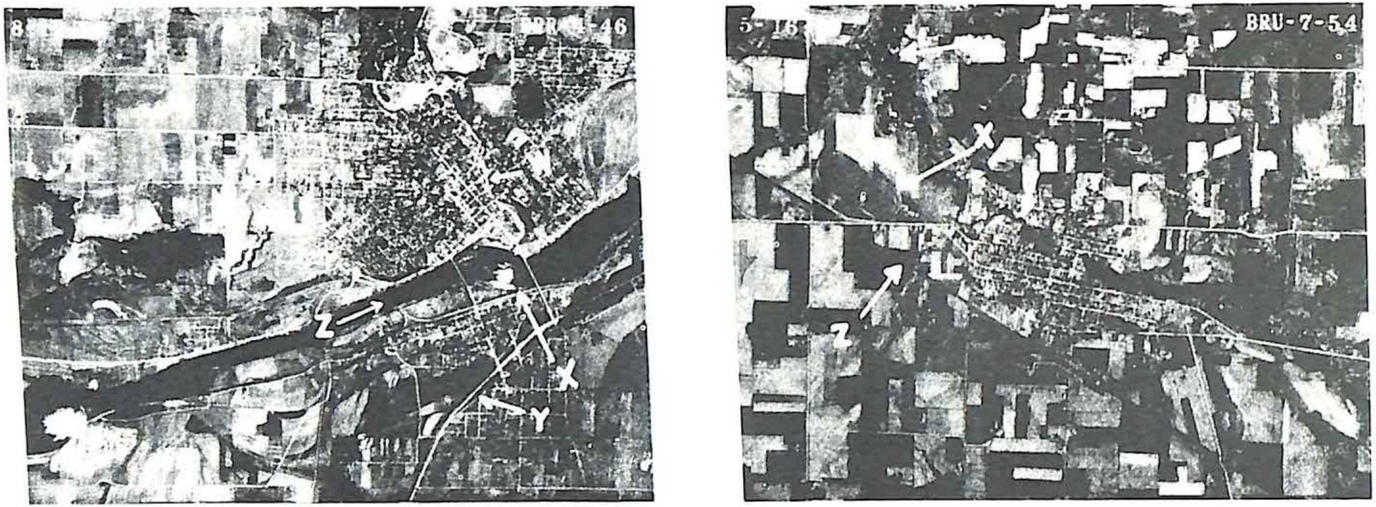
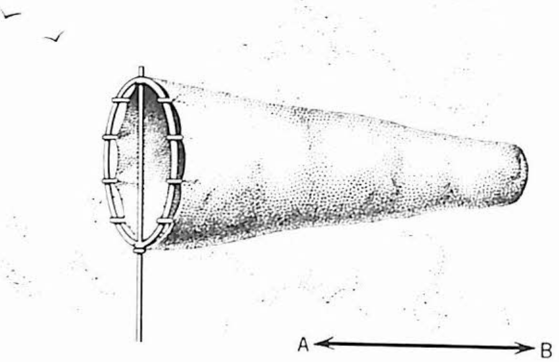


FIRST SAMPLE ITEM

SECOND SAMPLE ITEM

Figure 4.4 Sample problems from Spatial Orientation II.



1. In which direction is the wind blowing?

1–A Direction A
1–B Direction B
1–C Either direction A or B

Figure 4.5 Sample problem from Mechanical Principles Test.

Mechanical Principles. This test was patterned closely after Bennett's Mechanical Principles Test, except that the items were cast in an aviation setting. Each item was a pictorial presentation of a mechanical problem involving levers, trusses, inertia, or some other device or principle. An illustrative problem is shown in Figure 4.5. Factor analytic studies indicated that a number of different abilities were involved in performance on this test. Loadings of 0.20 or more were found as follows:

Mechanical experience	0.60
Visualizing	0.51
Verbal comprehension	0.22
General reasoning	0.20

The test was made up of 30 items. When scored $R - W$, it gave a mean of 9.46 and a standard deviation of 9.36. When this scoring system was used, it gave a substantial number of negative scores, so a constant (20 points) was added to all scores. Several reliability studies were made correlating odd versus even items and the coefficients averaged about 0.75.

General Information—Pilot. This test was composed of a rather heterogeneous collection of information items selected because they appeared to have validity for predicting success in pilot training. One large group dealt with information about planes and flying techniques. An item illustrative of these is the following:

The plane with a cannon in its nose is manufactured by

A. Bell
B. Boeing
C. Sikorsky
D. Douglas
E. Vultee

Other items had to do with such hobbies as skiing, sailing, and motorcycling. Items of this sort were found to be predictive of pilot success. An illustrative item is the following:

On most motorcyles, the throttle is operated by

A. pressing a lever on the handle bar
B. depressing a foot pedal
C. turning one of the handle grips
D. depressing a foot pedal for quantity and turning
E. don't know

Certain items, dealing with such things as chess or stamp collecting, were found to have negative validity, and these were scored in the reverse direction.

This test appeared quite heterogeneous in content, and it was also heterogeneous in factor structure. The factor loadings reported for it were as follows:

Pilot interest	0.38
Verbal comprehension	0.35
Mechanical experience	0.30
Perceptual speed	0.23

The complexity of this test makes it difficult to interpret any results that may be obtained for it in relation to civilian jobs, and it will receive relatively little emphasis in later chapters.

The score for the test was simply the number of "right" answers, and scored in this way it had a mean of 35.13 (out of a possible 60) and a standard deviation of 6.57. Reliability, based on odd versus even numbered items, was found to be 0.87.

General Information—Navigator. Mixed with the 60 pilot items were 40 items that yielded a separate score weighted for navigator selection. These were items dealing with the terminology of astronomy, trigonometry, and science. An illustrative item is the following:

Time is usually calculated with reference to

A. the Naval Observatory in Washington
B. zero degrees latitude
C. Greenwich
D. the International Date Line
E. the League of Nation's Observatory in Geneva

Factor analyses indicated this test to be primarily a measure of verbal comprehension, since no other factor appeared with a loading above 0.20. The verbal loading was 0.75.

This test had a mean of 20.57 and a standard deviation of 6.05. The odd-even reliability was about 0.80.

Biographical Data Blank. The test battery included a Biographical Data Blank which yielded 112 distinct items of information. These dealt with matters of family background and setting, liking for and success in school subjects, extracurricular activities, hobbies, and work experience. The items had been validated against the criterion of training school success, and empirical keys had been developed for pilots and navigators.

Since the items going into a score on this test have no basic unity, the score does not readily permit of interpretation in terms of psychological concepts of established meaning. However, some help can be gotten from factor analytic studies. The only significant factor for the Navigator score was one designated Mathematical Background, which had a loading of about 0.45. However, the test had quite low communality and thus had a fair amount of specific factor variance, in spite of its low reliability. The pilot score had loadings as follows:

Mechanical experience	0.51
Mathematics background	0.30
Numerical	-0.22

Means and standard deviations for the two scores were as follows:

	Mean	S. D.
Pilot	27.31	6.89
Navigator	20.57	6.05

The means are not readily interpreted, since there were both positively and negatively weighted items in each scoring key and a constant of 20 had been added to eliminate negative scores.

Reliability for the test by the split-half method was only 0.62 for the pilot score and 0.35 for the navigator score. These values were obtained even though an attempt was made to divide the items into approximately equivalent halves. Retest reliabilities were higher, being 0.86 for the pilot score and 0.49 for the navigator score in one sample retested after an interval of 28 days.

In the case of the Biographical Data Blank there was available for our study not only the two scores for each individual but also the original answer sheet. From this it was possible to determine what response each person had made to each item. Thus, we had the possibility of examining the item responses for each occupational group to see upon which items they differed from the sample as a whole. We also had the possibility of relating item responses to measures of success within each occupational group. The items in the Biographical Data Blank are reproduced in Appendix A. An inspection of them will indicate the nature of the raw material available for our study.

The tests described so far were all paper-and-pencil group tests that could be administered to groups of 100 or more applicants at a time. These occupied one full day of testing. In addition to the group tests, the test battery included six individual apparatus tests. The apparatus tests were given on a following day and took about half a day. Tests were administered to groups of four men at the same time, using four copies of the apparatus and four time clocks, counters, or other recording devices. A squad of four men moved through the series of tests as a unit, taking first one test and then another. Different squads started at different points in the testing sequence, and took the tests in different order.

The individual tests presented a number of practical problems that did not arise with the group tests. These centered around the issue of uniformity from one copy of the apparatus to the next and of a single piece of apparatus over a period of time. It was often found that two presumably identical copies of an apparatus test gave consistently different scores, one being apparently easier than the other. To allow for this, standard scores were used on all apparatus tests, and separate standard score conversion tables were provided for different copies of the apparatus. Elaborate maintenance procedures were developed to keep a piece of apparatus giving consistent scores, and quality control procedures were used to help identify pieces of apparatus that started to go "out of control." All in all, the testing was probably as meticulous as any ever carried out in a program of apparatus testing. Although the variations described above may have had some effect upon the scores of individuals, the error variance that they introduced was probably a very minor factor in the final scores.

When an apparatus test was being administered to a group of 4 men, the administration procedures were very completely specified. Instructions were learned verbatim, and test administrators were rehearsed on both the verbal instructions and the demonstrations that they gave to the examinees. In general, for each of the tests the examinees were given a very full explanation of the nature of the apparatus and of their task. The examiner also demonstrated the procedure in some detail. An attempt was made to be sure that each examinee knew what he was supposed to do, so that score differences would depend primarily upon skill in doing it, and not on ability to figure out what the task was supposed to be, or how it was supposed to be attacked.

The six apparatus tests in the July 1943 battery are described in the following paragraphs.

Finger Dexterity (Peg Turning). In this test, the examinee was presented with a form board with 48 square holes, each occupied by a square peg with a round top. One half of the peg's top was painted blue and the other half yellow. The pegs fitted easily but snugly into the holes. The examinee's task was to lift each peg in turn out of its hole, rotate it through 180 degrees and reinsert it. He used one hand—his preferred hand for the task. Five trials were given, each 35 seconds in length. After each trial, all pegs were turned so that they were facing the same way for the next trial. Score was the sum of the number of pegs turned in the 5 trials, but this was converted to a standard score with mean of 50 and standard deviation of 10 before it was entered on the man's record.

The functions that this test was believed to measure are indicated by its name and description. It was a test requiring quick and accurate eye-hand-finger coordinations and rapid adjustment to a new motor task. The test was included in several factor analyses of classification batteries, and loadings of 0.20 or more were found for factors designated as follows:

Psychomotor coordination	0.34
Psychomotor precision	0.28
Visualizing	0.27
Perceptual speed	0.20

However, common factors account for only a small part of the reliable variance in this test, and a large part of what it measures is specific to it. The nature of this variance is presumably indicated by the title and description of the test.

Since test results were expressed as standard scores, the mean in the population equals 50 and the standard deviation 10. When estimates of reliability were based on correlations between successive trials, values averaged about 0.93, but when reliability estimates were based on re-

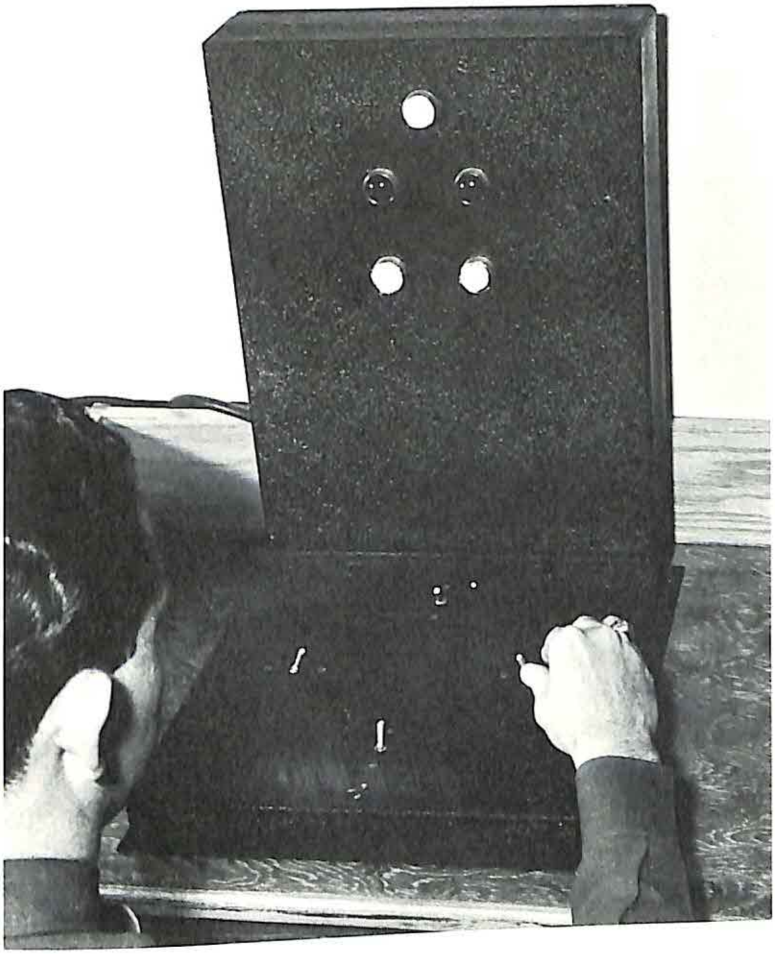


Figure 4.6 Apparatus for Discrimination Reaction Time Test.

testing after a time interval, the values obtained averaged about 0.75 to 0.80.

Discrimination Reaction Time. This test called for a discriminative motor response to a visual stimulus. The apparatus is shown in Figure 4.6. As indicated in the figure, the stimulus panel provided a white signal light and four stimulus lights—two red and two green. Stimulus lights were always presented in pairs—one green and one red. It was possible for the red light to be either above, below, to the right, or to the left of the green light. The response panel contained four toggle switches. The correct switch, i.e., the one that would turn out the signal lamp, had the same relative position on the response panel as the red light had on the signal panel. Thus "red right of green, press right hand switch."

The stimulus patterns were presented in sets of 20 with a 30 or 40 second rest between sets. Within sets, stimuli followed one another at intervals of approximately 4 seconds. Each subject's score was the cumulative total of the time that he took to make 80 responses. The only penalty for an error was that the signal light did not go out and the time clock did not stop, so that the subject continued to accumulate time until he pressed the correct switch.

In terms of common factors, this appeared to be a complex test with no factor clearly predominating. The following factors were identified:

Spatial relations	0.42
Psychomotor precision	0.35
Perceptual speed	0.22
Visualizing	0.20

This test also had a large amount of specific variance, not accounted for by factors common to other tests in Air Force batteries.

Scores were reported as standard scores with mean of 50 and standard deviation of 10. Since a low score (short time) was a good score, this low raw score became a high standard score. Reliability estimated from intercorrelations of trials ran about 0.90, whereas retest reliabilities after a lapse of time were about 0.75.

Two-Hand Coordination (Lathe Test). The apparatus for this test involved two control handles like those controlling the cutting tool of a lathe. Each of these drove a screw through which the motion of a pointer contact could be controlled in one dimension. By appropriate rotation of the two control handles, the subject exercised two-dimensional control over the pointer. His task was to keep the pointer in contact with an irregularly moving contact button. His score was the length of time that contact was maintained during a series of 8 one-minute trials. An illustration of the subject's test apparatus as seen from above is shown in Figure 4.7.

The test required the subject to adapt rapidly to a new psychomotor task, habituating the proper direction of rotation of handles, and learning which hand controlled which direction of movement. It also called for promptness and even anticipation in motor response, quick reversal of erroneous responses, and ability to avoid motor blocking. Previous experience with a lathe would appear likely to be helpful. In factor analytic studies, the main loadings were found in apparently

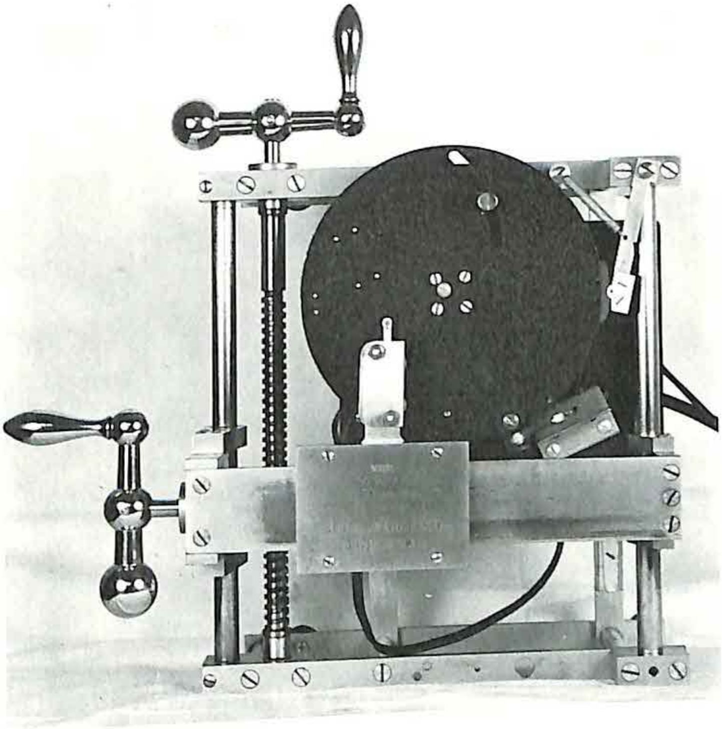


Figure 4.7 Apparatus for Two-Hand Coordination Test.

spatial factors, though these were not too clearly defined. Loadings above 0.20 were reported as follows:

Spatial relations	0.41
Spatial III (exact nature not clear)	0.58
Mechanical experience	0.40
Psychomotor coordination	0.34

If all of these factors are included, they account for most of the variance in this test. However, much of the variance appears to fall in the poorly defined spatial factor, so that the exact nature of the abilities measured is not made too clear.

Scores were reported as standard scores with mean of 50 and standard deviation of 10. Reliability appeared to lie somewhere between 0.80 and 0.90, whether based on correlations between trials or retest after an interval.

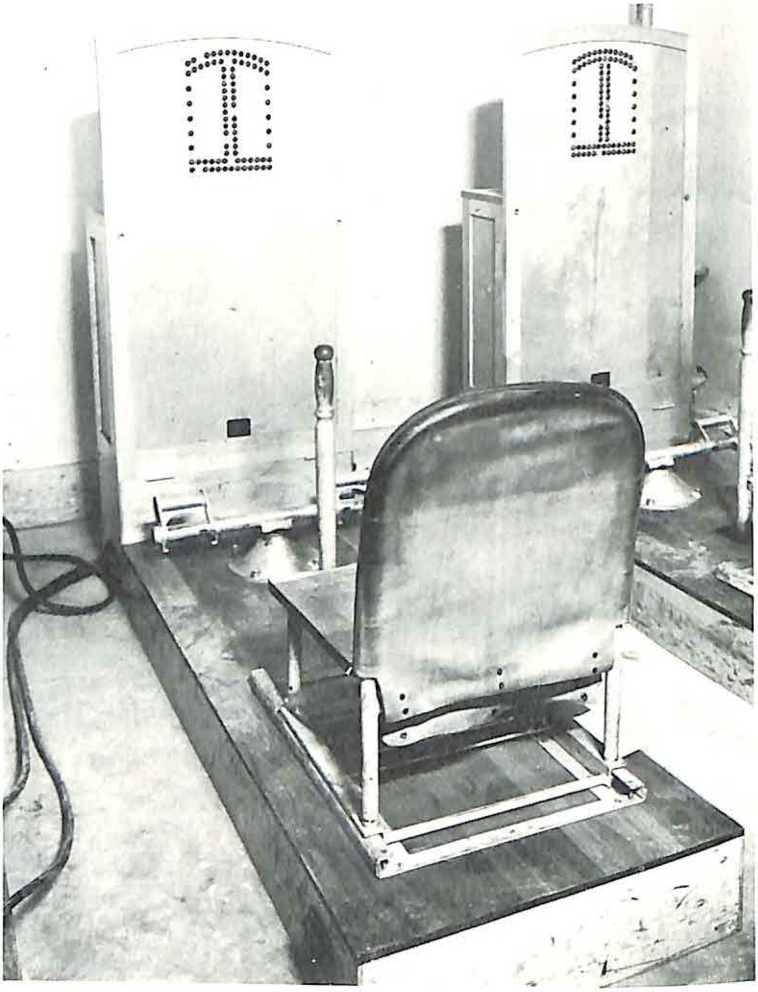


Figure 4.8 Apparatus for Complex Coordination Test.

Complex Coordination Test (Airplane Stick and Rudder). This test was in a sense a job miniature test for the pilot, in that he used the hand and foot controls that are basic to flying a light aircraft. The apparatus is illustrated in Figure 4.8. The examinee sat in the seat with his feet on the "rudder bar" and his preferred hand on the "joy stick." The stimulus panel had on it three rows of paired lights—one red and one green. A pattern of red lights appeared, and the subject had to match it with the corresponding green lights. The green lights were controlled by the stick and rudder. Lateral movement of the stick controlled the green light in the upper curved row; fore-and-aft movement of the stick controlled the green light in the central vertical row; movement of the rudder bar controlled the green light in the bottom horizontal row.

The subject's task was to match a pattern of red lights with the corresponding pattern of green lights. As soon as he did this, a new pattern of red lights was presented. New patterns continued to appear as rapidly as they were matched. The raw score was the number of patterns matched during an 8 minute test period. The subject achieved a high score if he quickly learned to translate the spatial positions on the stimulus panel into amounts of control movement, and if he were rapid and accurate in making those movements. In terms of the common factors found in factor analyses, the Complex Coordination Test was found to have the following loadings:

Spatial relations	0.49
Psychomotor coordination	0.40
Perceptual speed	0.20

In spite of these and a number of other smaller loadings, the test still had a good deal of specific variance, and performance is only partially accounted for by common factors.

As with the other apparatus tests, standard scores were used with mean of 50 and standard deviation of 10. Reliability of the test may be estimated as from 0.85 to 0.90 when based upon fractions of a single testing period, and about 0.80 when based upon retest after an interval of several weeks.

Rotary Pursuit with Divided Attention (Turntable Test). This test was based on the Koerth Pursuit Rotor, a piece of apparatus that had been used extensively in psychological laboratories to study the acquisition of simple motor skills. The basic apparatus consisted of a rotating turntable, like that of a phonograph, with a target button on it. The subject's basic task was to keep a jointed metal stylus resting on and in contact with the target button while the disk rotated. A series of 15 trials were given, each 20 seconds in duration, with rest periods after each 5 trials. Score was the number of seconds that contact was maintained between the stylus and the contact button.

Since ability to keep track of several things at one time was thought to be important for success as a pilot, an additional complication was introduced in the task. A box with two colored signal lights and two response buttons was placed beside the turntable. Using the hand that was not holding the stylus, the subject was required to hold down the button corresponding to the light that was on. Whenever the light changed, he had to shift to the other button. He received a score

Table 4.1

Tests in Aircrew Battery, Showing Main Factor Loadings

	Factor Composition						
	V	*N*	*MB*	*R*	*P*	*ME*	*Vz*
Reading Comprehension	0.60			0.27		0.37	0.24
General Information—Navigator	0.75						
Mathematics	0.37	0.51	0.37	0.24			
Arithmetic Reasoning	0.27	0.48		0.47			
Numerical Operations I and II		0.80					
Dial and Table Reading		0.53			0.31		
Speed of Identification					0.70		
Spatial Orientation I					0.62		
Spatial Orientation II					0.54		0.25
Mechanical Comprehension	0.22			0.20		0.60	0.51
General Information—Pilot	0.35				0.23	0.30	
Two-Hand Coordination						0.40	
Complex Coordination					0.20		
Rotary Pursuit (divided attention)							0.20
Finger Dexterity					0.20		0.27
Aiming Stress							
Discrimination Reaction Time					0.22		0.20
Biographical Data—Pilot		−0.22	0.30			0.51	
Biographical Data—Navigator			0.45				

Factor Titles

I	Pilot interest
M	Visual memory
MB	Mathematics background
ME	Mechanical experience
N	Numerical fluency
P	Perceptual speed
PmC	Psychomotor coordination
PmP	Psychomotor precision
PmS	Psychomotor speed
R	General reasoning
S	Spatial relations
S_{III}	Spatial factor III
SS	Social studies background
V	Verbal comprehension
Vz	Visualizing

only if both (1) the stylus was in contact on the turntable and (2) the correct button was pressed down. Thus, the test involved on the one hand mastering a large-muscle-eye-hand coordination and on the other maintaining vigilance over a peripheral visual signal. The main common factors involved were reported as follows:

Psychomotor coordination	0.54
Spatial III (nature unclear)	0.53
Visualizing	0.20
Psychomotor precision	0.20

If one includes the rather obscure factor labeled Spatial III, a rather large part of the nonchance variance on this test is accounted for. However, because of the lack of clear meaning for this factor, one must

Table 4.1 ***(Continued)***

	Factor Composition							
	S	*PmC*	*PmP*	*PmS*	*I*	*M*	*SS*	*Sm*
Reading Comprehension								
General Information—Navigator								
Mathematics								
Arithmetic Reasoning								
Numerical Operations I and II								
Dial and Table Reading	0.42							
Speed of Identification				0.21		0.20		
Spatial Orientation I							0.20	
Spatial Orientation II								
Mechanical Comprehension					0.38			
General Information—Pilot								0.58
Two-Hand Coordination	0.41	0.34						
Complex Coordination	0.49	0.40						0.53
Rotary Pursuit (divided attention)		0.54	0.20					
Finger Dexterity		0.34	0.28					
Aiming Stress		0.37						
Discrimination Reaction Time	0.42		0.35					
Biographical Data—Pilot								
Biographical Data—Navigator								

conclude that the nature of the abilities measured by this test is somewhat unclear.

Using standard scores, the test has a mean of 50 and a standard deviation of 10. Reliability as estimated from the correlation among trials was very high, values around 0.95 being obtained. However, retest reliabilities were lower, one study giving 0.88 for immediate retest and another giving 0.74 for retest after four weeks.

Aiming Stress (Hand Steadiness). The basic task in this test was to keep a stylus pointer in a target hole without touching the edges of the hole. The stylus was mounted on a fulcrum near the end held by the subject and pivoted freely in all directions. Thus, any movements of the subject's hand were magnified at the tip of the stylus in the target hole. Score was the number of contacts made with the side of the hole during six 40-second trials. (The device was constructed so that during continuous contact with the side of the hole contacts were recorded at the rate of 250 per minute.)

Since emotional stress appeared to be one of the problems in learning to fly, an attempt was made to introduce “stress” into this test. This was done by verbal heckling and distracting instructions during 4 of the 6 trials. Errors were apparent to the subjects through a light that flashed on every time that contact was made with the side of the target hole.

This test had relatively little in common with the other tests in the battery, and shows up with only one common factor loading of appreciable size; a loading of 0.37 on psychomotor coordination. Thus, the test was largely measuring specific factors—possibly of muscular steadiness, possibly of emotional control. The functions measured by the test are far from clear at this time.

Like the other psychomotor tests, this one yielded standard scores with a mean of 50 and a standard deviation of 10. Reliability estimated from the correlation between trials appeared to fall between 0.90 and 0.95, whereas an immediate retest gave a reliability coefficient of 0.86.

In the tables of the third part of this book, in which the test profiles for different occupational groups are presented, the tests have been arranged in a different order so as to group together scores that are measuring somewhat the same factors. The list of scores, in the order in which they appear in all the tables with a brief characterization of the factors that are believed to be measured by each score, is given in Table 4.1.

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CHAPTER 5

Tracking Down the Men and Gathering Occupational Data

As indicated in the previous chapter, the experimental group upon whom the study was carried out consisted of about 17,000 men who had been given the battery of Aviation Cadet tests between July and November 1943. From Air Force records we obtained each man's name, his enlisted Army serial number, and the testing number that he received when he took the Aviation Cadet tests. Army serial number and Aviation Cadet testing number were invaluable when it came to locating an address for each man, and to collating other information about him with his test records. It would probably have been impossible to carry out the study without these tags to help us trace each man. Certainly, the cost of the study would have been increased substantially, and the yield of completed cases would have been greatly reduced. Military personnel are in many ways ideal for follow-up studies because they *do* have such markers attached to them, and because various types of records are available on them in the offices of the Veterans Administration (VA), the Military Personnel Records Center, and in the Reserve Records sections of the several services.

PROCEDURES FOR LOCATING MEN

At this point in our work we were very fortunate in being able to enlist the help of the VA in locating addresses for our sample. The Washington office of the Veterans Administration has an alphabetic file containing the name and serial number of substantially every veteran who has ever been in touch with the VA for any type of benefit or service. This includes all cases of educational benefits, medical or dental benefits, housing loans, and also all with National Service Life Insurance. Each man has a unique number corresponding to his claim file or a unique insurance number or both. A locator file arranged by number indicates for any man the regional office in which his records are kept.

A roster of names and serial numbers was supplied on IBM cards to the VA. This roster was checked against the files just described. The cards for all who were known to be deceased were returned at once. If a man had a claim number, his card was sent to the regional office in which his records were shown to be located. If no claim number showed, but the man had an insurance number, his card was sent to one of the four centers handling National Service Insurance. In this initial search, the VA was able to identify the person referred to and take one of the three courses of action described above on *all but eight* of the cards that had been sent to them. A few of the identifications later turned out to be erroneous, but even so the proportion of successes seemed to us quite outstanding. Almost all of the cards sent out to local and regional offices were eventually returned, so that a tentative address was received for almost every living member of the original sample.

Working with the list of addresses supplied by the VA, we sent a letter and brief questionnaire to each man. Copies of all letters sent out are shown in Appendix B. After ten days, a postcard was sent which expressed thanks if the man had already returned the questionnaire and urged him to send it in if he had not already done so. About four weeks after the first letter, a second letter was sent. This was followed up after another four weeks by a third letter, enclosing a reprint of a *New York Times* article describing the study. All letters were sent by first-class mail and had enclosed a stamped return envelope.

No exact count of the returns to the first, second, and third letters was possible because a later letter often brought back the original copy of the questionnaire. However, it seemed quite evident that a substantial yield was still being produced by the third letter. Possibly additional letters would have continued to be productive, but we believed that we had reached the point at which further returns would hardly have repaid the effort. Special steps were taken to get as complete a return as possible on a fraction of the original group of nonrespondents, and these procedures will be described later in the chapter.

As might have been anticipated, a substantial fraction of the addresses supplied by the VA were out of date, and many of the letters sent out to the men were returned as undeliverable. This was true particularly of the claim addresses. Many of the bad addresses were generated by claims for educational benefits. Often the address that appeared on such a claim was that of some college fraternity house or some trailer camp in a college town. The address was often several years old. In all, about a third of the letters sent out to addresses supplied by the VA were returned as undeliverable. When a letter to a claim address was returned thus, we checked to see if the man had a VA insurance number. If he did, his card was returned to the VA for checking to see if the insurance address was different from and more recent than the claim address. A substantial number of the bad-address cases were salvaged in this way.

When no new address was elicited by this procedure, or when the new address also proved inadequate, we turned next to the Army Records Center, St. Louis, Missouri. This large, cooperative, and efficient records organization houses the personnel records of all Army and Air Force personnel who have seen service since approximately 1900. Complete records of persons who have been separated from the service are housed here, and the Center also has partial records on most individuals still in the Reserves or on active duty. From this Center we got one of the following types of information on almost every case submitted to it:

(1) A notation that the man was still on active duty.

(2) A notation that he was in the Active Reserve.

(3) If neither of the above held true, the address of his next of kin at the time of separation from military service.

Names of men still on active duty were set aside for a special study, based primarily on Air Force officer personnel records. Names of those in the Active Reserve were sent to the Air Force Reserve Records Center in Denver for an up-to-date address. When the address of next of kin was supplied, a letter was sent to that address describing the study and requesting a current address for the man so that the questionnaire could be sent to him. Questionnaires were then sent to the man at this address. Of course, since the next-of-kin addresses dated in most cases from 1945 or 1946, many of these were also out of date. If the letter to this address was returned as undeliverable, the case was considered lost. Also, no follow-up was made on the initial letter to next of kin. Our final records show about 1250 cases incomplete for these reasons and 800 cases that were not checked with the Army Records Center because they reached this phase of the follow-up too late.

When the first letter to a man was not returned by the postal authorities, it was originally assumed that the letter had been delivered. However, we found that this was an unsafe assumption. Copies of the second or third letter were often returned as undeliverable even when no such action had been taken on prior letters. One must conclude that many things can happen to a first-class letter beside its being delivered to the addressee. So even when none of the three letters was returned, it was still not possible to assume that the letters had reached their mark. One check on this point can be made by using the service which the Post Office Department provides for checking address lists. For quite a nominal charge, the postal authorities will check an address provided to them indicating either (1) that mail is being delivered to that person at that address, (2) that mail is being forwarded to a specified new address for that person, or (3) that the person has moved and no forwarding address is available. In this way, it was possible to locate new addresses for some of our cases, and questionnaires were sent to these addresses on the assumption that the previous questionnaires might not have been forwarded. Addresses identified by postal tracer as "moved—no forwarding address" generally received the next-of-kin treatment.

A final attempt was made to reach part of the men whose address was apparently correct and up-to-date but who had not responded to any of the letters. In this part of the research, the services of the Retail Credit Company were employed. This company maintains a nationwide network of offices devoted to getting information from or about people. We found this organization a very useful research tool.

Intensive Follow-up and Estimates of Sample Bias. Two groups were followed up by Retail Credit investigators. An initial group of 534 was used first to test the methodology of follow-up, and then for an exhaustive search in which an attempt was made to track down every possible man. A second group of about 1500 was followed up only to the extent of making phone calls to the individual's address in an attempt to speak to him and get the desired information.

The group of 534 was originally divided into two subgroups to test two variations of procedure for reaching respondents. In one set of communities, contacts were made only through phone calls; in another set of communities chosen to be roughly comparable in size and geographical region, phone calls were supplemented by personal calls. Comparing the two treatments, we found that the phone call alone elicited information in 143 of 268 cases, whereas the phone call supplemented as needed by home visits elicited returns in 114 of 266 cases. It appeared that the home visits had not increased the yield of completed cases, and it was on this basis that the phone call alone was used for the further group of 1500 cases.

For those in the group of 534 who were not reached successfully in the initial Retail Credit Company approach, the following procedures were followed:

(1) If the initial call had uncovered a new address for the man, he was transferred to the new Retail Credit office and called or interviewed there.

(2) If the man had refused to cooperate, or if it had been impossible to reach him, a standard Character and Credit Report was obtained for him. This report is obtained by Retail Credit from sources other than the man himself. It could provide only part of the information in which we were interested, but it did usually give information on job and approximate income.

(3) If the man had moved and no address was available for him a "Skip Locator" Report was obtained. This, as the name suggests, is a systematic inquiry at the place of residence and in the neighborhood designed to develop a new address for an individual—typically an individual who has left unpaid bills.

The above three types of inquiry were used in varying sequences until we had either acquired information about the man or reached a dead end that ruled out further inquiry except at excessive cost. Information of some degree of completeness was obtained for 480 of the original group of 534, whereas 54 remain unreached. The outcomes of the Retail Credit search for these men are summarized in Table 5.1.

This intensive follow-up study was carried out in order to provide some information on the nature and extent of the bias among the respondents. One anticipates that those persons who reply to a request for information about their educational and occupational histories will not be truly representative of the whole group to whom the inquiry was sent. It seems likely that the respondents will be generally more successful than the group as a whole, and that those in lower level jobs will be inadequately represented. It seems especially likely that those who are in some degree in overt conflict with society will fail to

Table 5.1

Outcomes for Intensive Follow-up Group

Cases Completed at Time of Initial Retail Credit Inquiry	No.	%
Essentially complete information supplied by respondent	243	45.4
Essentially complete information supplied by family	14	2.6
Partial information supplied, usually by family	17	3.2
Determined that man was in Armed Forces	28	5.2
Determined that man was deceased	6	1.1
Subtotal	308	57.6
Cases Followed by Intensive Further Inquiry		
Essentially complete information supplied by respondent	36	6.7
Essentially complete information supplied by family	4	0.7
Partial information supplied	1	0.2
Determined that man was in Armed Forces	6	1.1
Determined that man was deceased	1	0.2
Character-financial report completed by Retail Credit, providing information about the man	124	23.2
Moved, no forwarding address; unable to locate	54	10.1
Subtotal	226	42.3

respond. We can never get complete returns, but a comparison of those obtained by routine procedures with those obtained only with extreme difficulty should give some suggestion as to how much distortion has been caused by selective responding.

The most direct and objective indication of any selective effect will be found in the occupations of the two groups—the routine respondents and those tracked down only with great difficulty. In Table 5.2, this information is presented. Jobs are grouped according to the initial digits of their Dictionary of Occupational Title, Part I code numbers. The table makes possible an easy comparison in terms of percent engaged in the different main occupational groups.

The data from Table 5.2 indicate rather clearly that there was some bias operating with respect to the occupations of those who responded. The respondents included a higher percentage in professional and managerial positions, whereas those who were tracked down by more intensive search were more often in sales, clerical, skilled, semi-skilled, or unskilled jobs. The large group of routine respondents included fairly clearly an overrepresentation of those from the high-prestige types of occupations. Of course, the group as a whole tended to enter the higher occupations. This is a reflection of the fact that it was quite a select group. But this tendency appears to have been accentuated in the respondents.

A further indirect indication of bias in the group of respondents is the fact that only five or six of those located were in prison or in mental hospitals. Given a starting group of 17,000, even recognizing that they had been screened by medical examination as well as by aptitude tests, one would feel sure that a substantial number would be in some sort of institution. We had one positive identification of a man as being in prison, and had four or five cases for whom indirect evidence suggested institutionalization, but that was all. The individuals failing to adjust to society were not accessible to the fairly superficial type of search that we carried out.

At a less extreme level of nonadjustment, we found very few unemployed among our respondents. They amounted to only 0.7% of the group. Recognizing that 1955 to 1956 was a period of very full employment, it still seems likely that we failed to get response from many of those who were currently out of work.

Another type of evidence of bias can be sought in the test scores of the respondents. In our statistical work, we had no occasion to make other use of the scores of the nonrespondents, and we did not collate them into their separate subgroups just for this check on respondent bias. However, we did have the test scores for the respondents, and we did have the parameters for the population of approximately 75,000 from which the sample was chosen. These population parameters were

Table 5.2

Comparison of Occupations Found Among Routine Respondents and Special Follow-up Cases

DOT Codes	Description	Among Routine Mail Respondents	Responding to Retail Credit Call	Information Obtained Indirectly*
0.01 to 0.69	Professional and subprofessional	32.9%	20.7%	12.3%
0.70 to 0.99	Managerial and official	25.3	29.5	14.2
1.00 to 1.49	Clerical	5.7	5.4	17.9
1.50 to 1.99	Sales	11.1	10.9	19.5
2.00 to 2.99	Service	2.3	2.9	3.8
3.00 to 3.99	Agriculture	3.2	1.5	1.0
4.00 to 7.99	Skilled, semi-, and unskilled	17.1	27.3	30.2
	Students	0.7	1.8	0.0
	Unemployed	0.7	0.0	1.0
	Number of cases	9855	275	106

* Also 11 cases for whom no occupation could be determined.

Table 5.3

Test Score Means of Respondents Compared with Mean and Standard Deviation of Total Population

	Respondents	Total Population	
	Mean	Mean	S. D.
Reading Comprehension	21.49	21.82	11.34
General Information—Navigator	20.68	20.57	6.05
Mathematics	23.17	22.92	16.53
Arithmetic Reasoning	15.16	15.05	9.40
Numerical Operations I	37.54	37.21	12.36
Numerical Operations II	32.91	32.57	11.86
Dial and Table Reading	34.59	34.41	8.90
Speed of Identification	33.41	33.38	7.25
Spatial Orientation I	27.89	27.81	5.63
Spatial Orientation II	20.52	20.70	6.53
General Information—Pilot	35.10	35.13	6.57
Mechanical Principles	57.93	58.93	18.71
Two-Hand Coordination	50.04	*	*
Complex Coordination	49.97	*	*
Rotary Pursuit	50.06	*	*
Finger Dexterity	50.31	*	*
Discrimination Reaction Time	52.53	*	*
Aiming Stress	48.82	*	*
Biographical Data—Navigator	22.40	22.54	3.13
Biographical Data—Pilot	26.87	27.31	6.89

***Scores reported as standard scores with mean of 50 and standard deviation of 10.**

available only for the group tests. All individual test results were reported as standard scores with mean of 50 and standard deviation of 10. Conversion tables were prepared for each test, based on samples of test scores, and were revised from time to time as accumulated data indicated that this was necessary. Thus the presumption is that the population mean for each of these tests was 50.

Table 5.3 shows the means for approximately 10,000 cases for whom occupational data were obtained. The table also shows the mean and standard deviation for the total population of approximately 75,000 taking this test battery. It is apparent from this table that for all the group tests the differences between the total population and the respondent sample are relatively small.

The respondents score above the total population on 8 group tests and below the total population on 6. Most of the differences are very small. The only one that is more than a thirtieth of a standard deviation is Mechanical Principles, on which the respondents fell about a twentieth of a standard deviation below the total group. The general pattern is one of slight superiority of the respondents on numerical tests and slight inferiority on perceptual and mechanical ones. This is consistent with the finding of an underrepresentation of skilled trades in the respondent sample.

On the individual tests, the situation is somewhat less clear because we do not have actual data for the total group. However, in four of the tests the respondent mean corresponds quite closely to the theoretical value of 50. Substantial discrepancies are found for the Aiming Stress Test and particularly for the Discrimination Reaction Time Test. One suspects, without any solid evidence, that these tests had gone "out of control" during the period of the study, and that the standard score conversion tables were faulty. In view of the small differences on the other tests, this explanation seems more likely than the existence of genuine differences.

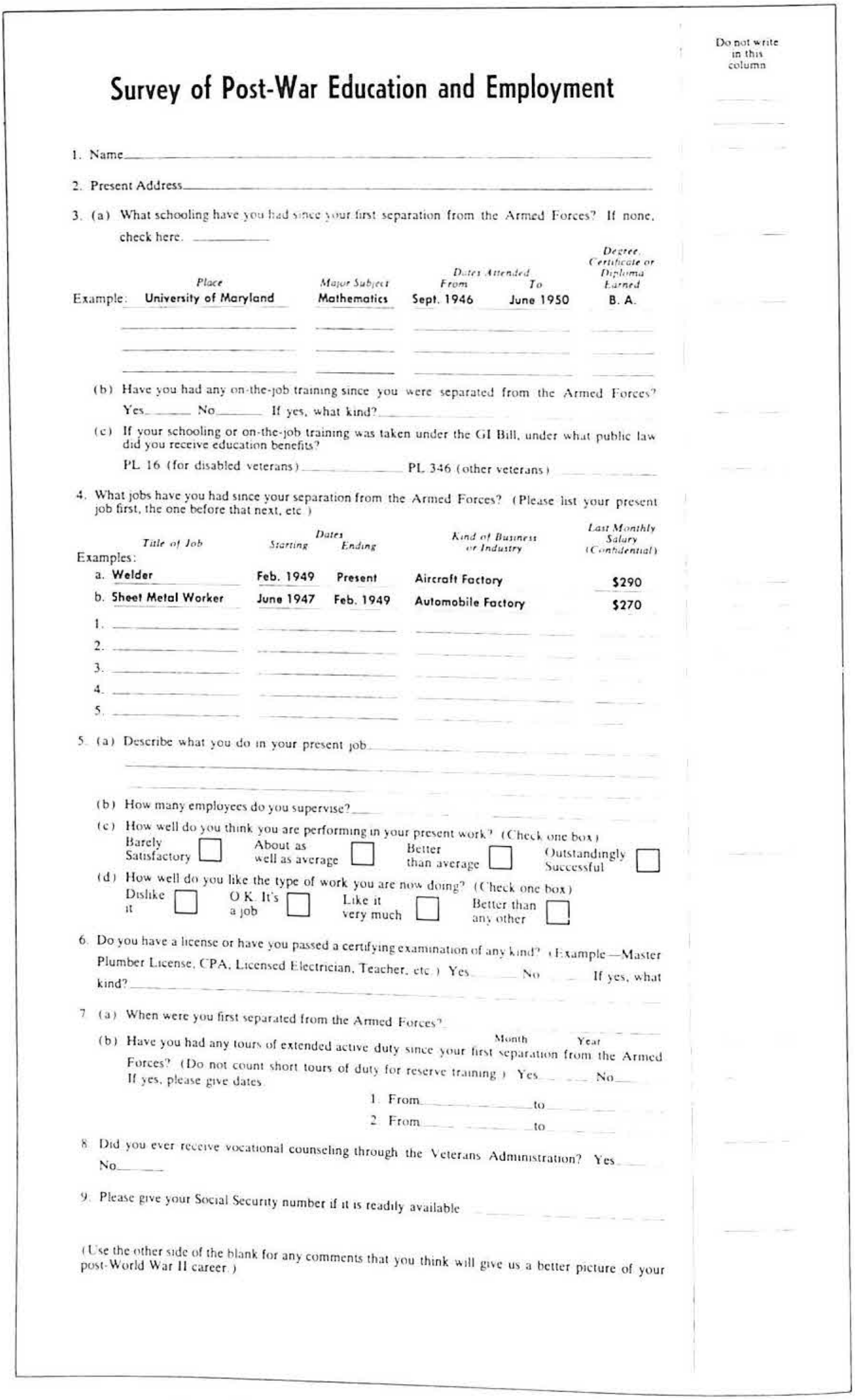
What was the final disposition of the approximately 17,000 cases with which we started? In order to answer this question, a check was made of the final disposition of a random 10% sample of the original group. This tally showed the following outcomes:

Questionnaires returned by respondent	51.3%
Information obtained through Retail Credit	7.1
Respondent is in military service	8.1
Individual is deceased	7.7
No response, address presumably correct	11.4
Individual lost, no acceptable address available	14.4

These percentages can be combined in various ways to give an indication of completeness of return. Perhaps the most suitable is to omit those in the military and those who are deceased, and consider the first two categories as a percentage of the first two plus the last two. If this is done, we end up with a percentage return of 69.4.

THE QUESTIONNAIRE

The basic instrument used to gather educational and occupational data was the one-page questionnaire reproduced in Figure 5.1. The questionnaire was deliberately held down to one side of one sheet of paper in order to encourage the largest possible return. We felt that it was better to get a small amount of information of critical impor-



Do not write in this column

Survey of Post-War Education and Employment

1. Name____

2. Present Address____

3. (a) What schooling have you had since your first separation from the Armed Forces? If none, check here. ____

	Place	Major Subject	Dates Attended From	To	Degree, Certificate or Diploma Earned
Example:	University of Maryland	Mathematics	Sept. 1946	June 1950	B. A.

(b) Have you had any on-the-job training since you were separated from the Armed Forces? Yes____ No____ If yes, what kind?____

(c) If your schooling or on-the-job training was taken under the GI Bill, under what public law did you receive education benefits?

PL 16 (for disabled veterans)____ PL 346 (other veterans)____

4. What jobs have you had since your separation from the Armed Forces? (Please list your present job first, the one before that next, etc.)

	Title of Job	Dates Starting	Ending	Kind of Business or Industry	Last Monthly Salary (Confidential)
Examples:					
a.	Welder	Feb. 1949	Present	Aircraft Factory	$290
b.	Sheet Metal Worker	June 1947	Feb. 1949	Automobile Factory	$270
1.					
2.					
3.					
4.					
5.					

5. (a) Describe what you do in your present job____

(b) How many employees do you supervise?____

(c) How well do you think you are performing in your present work? (Check one box)
Barely Satisfactory ☐ About as well as average ☐ Better than average ☐ Outstandingly Successful ☐

(d) How well do you like the type of work you are now doing? (Check one box)
Dislike it ☐ O.K. It's a job ☐ Like it very much ☐ Better than any other ☐

6. Do you have a license or have you passed a certifying examination of any kind? (Example—Master Plumber License, CPA, Licensed Electrician, Teacher, etc.) Yes____ No____ If yes, what kind?____

7. (a) When were you first separated from the Armed Forces?____
Month Year

(b) Have you had any tours of extended active duty since your first separation from the Armed Forces? (Do not count short tours of duty for reserve training.) Yes____ No____
If yes, please give dates.

1. From____ to____
2. From____ to____

8. Did you ever receive vocational counseling through the Veterans Administration? Yes____ No____

9. Please give your Social Security number if it is readily available____

(Use the other side of the blank for any comments that you think will give us a better picture of your post-World War II career.)

Figure 5.1 Questionnaire sent to all men in survey sample.

tance from the largest possible group of respondents than to get a fuller report from a smaller group. Every addition to the length of a questionnaire makes it more difficult to fill out and is likely to generate resistance to responding. We felt that there was a real advantage to holding the blank to one side of one sheet of paper, and restrained ourselves from asking possibly interesting collateral questions in order that this goal might be achieved.

The reason for including most of the questions that appeared on the blank is obvious. There are a few, however, that call for some explanation. These were to serve special purposes, or were put in with special uses in view. The simplest procedure for making clear the purpose of these questions, as well as to indicate the reason for the particular wording of other questions, is to consider the items one at a time, discussing the function of each.

1. Name. Obviously necessary.

2. Present Address. The report of present address served to bring up to date our address records, since in many cases the questionnaire was returned from an address different from the one to which we had mailed it.

3. Schooling and Formal Training Since World War II. The purpose of this group of questions was to get a complete picture of educational experience since World War II. We were interested in the possibility of studying test scores as predictors of type of schooling undertaken and successfully completed. The record of education also served in some cases to help throw light on the job history. Thus, the interpretation of a claim to be working as a sales engineer might be different in the case of an individual who had completed work in an engineering school than it would be for one who showed either no education at all or no engineering training. We were interested in the institution in which education was received because of a vague thought that we might try to obtain information from the institution and make some qualitative evaluation of academic success. The major subject was obviously important if we were to study education by distinct subgroups. The dates of schooling established the sequence of different programs undertaken and related schooling to work history. We were interested in the degree earned as an indicator of successful completion of a program.

The question about on-the-job training was an attempt to get some appraisal of training outside of formal educational institutions. It was thought that this would provide information on apprenticeship and other learning experiences on the job. Generally speaking, the items reported under this heading appeared rather difficult to classify and not very likely to be useful in further work. The question dealing with the G. I. Bill under which education was received was included primarily because of the interest of persons in the VA who felt that they might wish to make some analysis of the educational records of these men in relation to materials in their files related to testing and counseling.

4. Work History. This section was, of course, the heart of the inquiry. Our attempt was to elicit all the major jobs that the person had held since leaving the Armed Forces and to get them identified by at least a title and the type of business in which they fell. We also asked for monthly salary as one significant indicator of success. In most occupational groups at least 80 or 90% of the respondents provided this information. The percentage was lower in certain groups that are primarily self-employed or have irregular incomes, such as doctors, lawyers, and store owners.

5. Aspects of Present Job. The questions under 5 called for fuller information about the individual's present job and his reactions to it. In 5(*a*) we asked for a description of activities in the current job. The information received here was often extremely important in clarifying the job title and making it possible to assign a DOT job code number to the man with some confidence. This question elicited responses differing a good deal in clarity and detail, but provided extremely helpful and important information.

Under 5(*b*) we inquired into the number of employees supervised. The purpose was to get information that would be relevant as a criterion of job success. In this respect the question was somewhat less than satisfactory, because different respondents interpreted supervision in rather different ways. Thus, one factory manager might interpret number supervised as meaning the 8 or 10 men who reported directly to him, whereas another might interpret it as meaning all 500 men employed in the factory. It would require somewhat more elaboration than was provided by this simple question to get a comparable picture of supervisory responsibilities for different individuals. Of course, the relevance of supervisory responsibility as a criterion varies enormously from one occupation to another.

In 5(*c*) we tried to get the man's self-evaluation of his adequacy in his present job. Our hope was that this evaluation would deal with his effectiveness and not with his feeling of satisfaction about his performance. That is, we hoped to get not the man's expression of whether he was coming up to his own goals but rather his judgment of how he performed relative to others in the job. However, as one examines the responses and particularly as one relates them to test scores, one suspects that the responses to this question were contaminated by individual levels of aspiration, and that the individual rated himself in part by whether he came up to his own personal standards and only in part by whether he surpassed other workers in the job.

Question 5(*d*) was an attempt to get a simple and rough appraisal of job satisfaction. It is clearly recognized that the response to a single question of this type with only four response categories is crude and relatively unreliable. However, space did not permit a more elaborate inquiry on this point and it seemed that a single brief question might have some value as a different type of criterion indicator.

6. Licenses and Certifying Examinations. This question was included primarily to provide some further clarification of the material on occupational history. Thus, the possession of a plumber's license represented a type of documentation that the man was a successfully qualified plumber. The passing of examinations as a certified public accountant defined a somewhat more select subgroup working within the field of accountancy. In this particular case, the jobs of accountant were originally coded separately, depending upon whether a man was or was not a CPA. However, in the final analyses this differentiation was dropped.

7. Time of Separation from and Subsequent Duty in the Air Force. This question was included originally with the thought that in evaluating current occupational status some adjustment might be attempted to take account of time lost by military service. Thus, we had thought that we might make some allowance for time lost due to service in the Korean War. However, in the final analyses the attempt to make this adjustment seemed somewhat complicated and it was abandoned.

8. Veterans Administration Counseling. This question was included primarily on behalf of the VA. There was some thought that the identification of a subgroup who had received counseling from the VA would permit studies of that counseling in relation to subsequent occupational careers. A deck of IBM cards providing the coded information from the questionnaire was made available to the VA. No use was made of this item in the present study.

9. Social Security Number. The only purpose in getting a social security number was to obtain an additional tag upon the men that might be helpful if we attempted to follow them up at a later date and get measures of occupational success on them later on in their occupational careers. We felt that if we had the social security number it might be possible to locate men who had otherwise been lost through the records of social security.

CHAPTER 6

Organizing the Material for Analysis

With questionnaire responses on hand for 10,000 men, the next phase of the enterprise was putting the material in shape for statistical analysis. The size of the group, together with the fact that the test scores and Biographical Data Blank item responses were already on IBM cards, clearly dictated that punched cards be used for the statistical work. The heart of data processing by machine methods is the coding by which a great range of specific responses to the questionnaire items are reduced to a manageable set of qualitative or quantitative categories. This chapter is primarily concerned, therefore, with the coding decisions and procedures that reduced the data to manageable form. Consideration will be given primarily to coding of occupational data, with a brief account of the other items that were coded.

CODING OCCUPATIONAL DATA

Each man reported a condensed occupational history, together with a number of facts about and reactions to his present job. From this information it was necessary to develop a code for assigning individuals to occupational groupings and to select and plan codes for criterion measures of occupational success and satisfaction. We will consider first the problems and decisions involved in setting up occupational groups, and then the problems of extracting criterion measures from the record.

Setting up Occupational Groups. In the pilot study described in Chapter 1 it was found that 800 or so responses gave us cases in 154 of the 269 occupational categories of the 1950 census. Many of these categories were represented by only one or two cases. It seemed apparent that the 10,000 cases of the present study would scatter even more widely, and that some grouping of occupations would be necessary to yield samples of size adequate to provide stable statistics for different occupations. On the other hand, undue grouping together of jobs that are in fact somewhat different from one another may tend to blur occupational profiles and attenuate the validity of predictors. One faces a dilemma in wishing both for large samples and for homogeneous occupational groups.

The problem of how broadly one must group together related occupations is complicated by the fact that one does not know in advance how many individuals there will be in the sample who are in a specific occupation. Thus, until one knows how many physicists and how many chemists one has, it is hard to decide whether they should be kept as separate groups, or combined into a single group of "physical scientists." We decided, therefore, to approach the problem of setting up occupational groupings stepwise and empirically.

In our original coding of current occupation, we recorded the full Dictionary of Occupational Titles (DOT) code for each man's present job. Since these men had been working for some time, the code from Part I was used, rather than the Part IV code for entry occupations. A fair number of difficult decisions were encountered, where either the information on the questionnaire was inadequate to define the job clearly or no exact counterpart appeared in the DOT. These were resolved by conference between coders and supervisor, and each case was placed in some one DOT category.

When about half the cases had been coded, a listing and frequency count was prepared of all the DOT codes that had been encountered. Examination of the jobs reported and the frequency with which each occurred provided the basis for a broader grouping. An initial grouping was suggested by the senior author. This was then reviewed and criticized in detail by Dr. Donald Super of Teachers College and Mr. Sidney Fine of the U. S. Employment Service. Many modifications suggested by the reviewers were incorporated in the final grouping, which was again prepared by the senior author.*

In the final job groupings, the primary objective was to put together in a single category occupations that were similar as far as possible. The grouping was inevitably based in large measure on judgment, since little empirical evidence exists on the similarity of different jobs with respect to their aptitude requirements. Groupings were kept as homogeneous as possible, while still providing reasonably substantial numbers of cases. The nature of our population was such that considerably finer grouping was possible in some sorts of jobs than in others. Thus, we had a total of about 900 engineers among our respondents, and so it seemed reasonable to separate out for analysis subgroups of civil, chemical, electrical, mechanical, industrial, and sales engineers. On the other hand, we had so few semi-skilled workers that it was necessary to lump together a very heterogeneous group of "processing machine operators." Even this broad grouping contains only 45 cases, and is probably too small to provide meaningfully stable results. It was necessary, that is, to adapt our grouping to the material at hand, sinking a narrow shaft where the pay dirt ran deep, and scraping a broad area when the vein was thin.

We tended to keep rather more and smaller groups than could be justified in terms of statistical considerations, feeling that it is always possible to combine groups at some later stage in an analysis, if one has kept them separate, but that it is never possible to separate them once they have been combined. The result was 126 job groupings containing 9 to 522 cases. The complete list of groups is shown in Table 6.1 at the end of the chapter. This table provides the following information for each group:

(1) Three-digit identification code.
(2) DOT codes included in group.
(3) Title or titles of jobs in group.
(4) Number of cases.

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*The U. S. Employment Service has been working for some time on a new method for classifying jobs with view to revising the Dictionary of Occupational Titles so that the groupings will be more functional and meaningful. This method involves an analysis of each job in terms of functions performed and abilities required, and grouping jobs in terms of similarities in these dimensions. Mr. Sidney Fine made a supplementary attempt to group the jobs of the present study in accordance with these developing concepts. However, our resources did not make it possible for us to analyze two distinct groupings of the jobs. Therefore, we decided to use the more conventional grouping, related to the existing structure of the DOT, and more familiar to the practicing counselor and personnel psychologist.

A scrutiny of this table provides a good picture of the raw material that was available for the analyses reported in Part III of this book.

Criteria of Occupational Success. After we had set up a system of occupational groupings, our next problem was to devise a criterion or criteria of success within the occupation. The criterion problem has been widely recognized as one of the most difficult as well as one of the most crucial aspects of personnel research. The criterion measures possible to develop in this study certainly leave much to be desired. We shall describe them and give some evaluation of each.

Group Membership. The most rudimentary criterion of success in an occupation is found in the simple fact that the person is gainfully employed in that occupation. Thus, the mere fact that an individual reports employment as an electrical engineer means that he has been able to complete engineering training and to get a job as an engineer. If he has held a job in the occupation for several years, as is the case for most of our respondents, this implies at least a minimum level of adequacy within the job. The criterion of group membership appears more significant for those occupations that require rigorous training programs or that have standards for admission (i.e., bar examinations or CPA examinations). However, it is worth examining the mean test profile of the men in each occupational group to provide a guide as to how this occupation has selected men from the total group of cases available to us.

Occupational score profiles are almost certainly more meaningful for the highly selective occupations than for others. In particular, profiles of below average mean scores will be hard to interpret. Thus, if we find that auto mechanics are below average on most of the tests in our battery, this may not mean that ability is unimportant in an auto mechanic. It may merely mean that in the competition with law, engineering, business management, and so on, the occupation of auto mechanic has come off second best. That is, the selection has taken place not *by* the occupation but *away from* it. Low scores in any profile may mean only that that particular ability was *more crucial* for other occupations, rather than that it is completely unimportant (or even undesirable) for the occupation in question.

In our data, occupational profiles are especially suspect for the unskilled, semi-skilled, and even skilled occupations. This is due to the preliminary screening to which Aviation Cadets were subjected. As indicated in Chapter 4, a qualifying examination was used as one requirement for admission to the Aviation Cadet program, and the passing score on this examination was set at a level that would exclude at least the bottom half of high school graduates. Thus, there were few of our cases who would have scored below 100 on the AGCT or the Wechsler-Bellevue. They were basically an able group. This means that the sample of individuals from our population who ended up as truck drivers or laborers is undoubtedly quite unrepresentative of the total population of persons in those occupations. The level of mean score for these groups, and even the pattern of high and low scores, must be interpreted with great tentativeness and caution.

Income from Occupation. A simple and obvious indication of success in any occupation is the amount of money received for one's labors. Although income becomes relatively meaningless as one compares different occupations (i.e., a minister and a salesman), it seems much more satisfactory within a single relatively homogeneous occupational group. Admitting exceptions, we would probably all agree that as a first approximation the man who is making more money for his work as an architect, a drug salesman, or a machinist is more successful than one who is making less. For this reason, we have relied rather heavily on the man's report of his income from his work as a criterion measure of success. We recognize that the self-report may be inaccurate, distorted by pressures to maintain self-esteem on the one hand or to deceive the tax collector on the other. However, we have not seen any good reason why these inaccuracies should be systematically related to the test scores, so we have accepted reported income from his occupation as a somewhat unreliable but presumably an unbiased indicator of the man's success.

Some of our respondents were unwilling to report income to us, and this interfered with our use of this criterion. However, the proportion was fairly small for most occupations. There were only a few occupations in which as many as 10% of the respondents failed to respond to this question. The higher percentages of nonresponse occurred for self-employed groups with variable incomes, such as doctors, lawyers, and storekeepers. Our procedure, when analyzing the results of the study, was to assign any individual who failed to report his income the mean income for the group. Following this procedure could be expected to attenuate slightly any relationships between predictors and this criterion measure, but should not produce spurious relationships.

A number of factors operate to make income less than ideal as a criterion measure. Let us review some of the limitations at this point.

(1) Income is subject in some measure to geographical differences. What a successful lawyer or doctor may expect to earn depends in part on where he lives—in what region and in what size community. Although there may be some measure of self-selection, the more able

going where the financial opportunities are better, this will operate only in part, as family ties or inertia will hold some men in places where their opportunities to earn are less than their talents would justify. We considered attempting to make some adjustment for the place in which the man worked, but the difficulties in setting up an effective adjustment procedure seemed out of proportion to the probable gain. We must therefore recognize that differences in place of residence and employment have served as one factor attenuating relationships between test scores and reported income.

(2) Income in some occupations is determined in large measure by civil service pay schedules or by union contracts. If there is an established pay schedule for postal clerks, and if promotions are based primarily on seniority, it is unlikely that income will be related to any measures of aptitude. By the same token, if the union rate for plumbers is $5.25 an hour, one plumber can earn more than another only by being more fully employed. During a period of generally full employment, this is not likely to be an important differentiating characteristic. We cannot expect much relationship of income to predictor variables, then, for those occupations in which financial return is determined by factors outside the individual's control.

(3) Even where income in an occupation varies widely, income is often an imperfect measure of the individual's effectiveness in his occupation. A district attorney, working for quite a modest salary, may be doing as good a job and making as important a social contribution as an attorney in private practice making two or three times as much. Similar examples could be cited from other fields.

(4) Income may in some cases be determined by inheritance, family influence, or similar factors outside the control of the individual being studied. Thus, our records do not permit us to determine, in many cases, whether the prosperous farmer has become so through his own efforts or has inherited the family farm. When a man holds an executive position in a small manufacturing concern, we do not know whether he gained the position on his merits or through being the owner's son. We would expect these influences generally to attenuate relationships of predictors to income, and yet it is possible that in some cases they may not. Thus, if the prosperous farmer has provided his son not only with a farm but also with superior educational and environmental opportunities, it is possible that these two kinds of contributions may have produced a spurious relationship between abilities and income in the succeeding generation.

(5) Finally, one must recognize the existence of a large component of sheer chance in the specific job which a man has initially obtained,

and consequently in his opportunities for financial advancement. The people he happens to have met in military service, chance social contacts at home, the job opportunities that happened to be open on the specific day or week he was seeking employment may all be influential in determining a man's initial job, and this original start may have been a major determiner of later progress.

The factors described above would generally tend to reduce relationships between income and aptitude measures. For this reason, the failure to find significant relationships must be considered somewhat inconclusive. If one were to find a substantial number of statistically significant correlations, one would feel that one could accept them as probably underestimating the true relationships. When one finds few correlations that meet the standard of statistical significance, as was the case in the present study, one cannot be sure whether the failure is due to the basic lack of relationship between aptitude measures and later effectiveness on the job or to the inadequacy of reported income as an index of that effectiveness.

Number Supervised. One aspect of success, in some occupations at least, is that a man is responsible for the work of others. For this reason, we asked each man to tell us the number of persons whom he supervised. Partly for convenience in machine tabulations and partly because responsibility was believed to be something of a logarithmic function of the number supervised, the actual number reported was converted by an approximately logarithmic transformation. The actual code used was as follows:

Code	Number Supervised
0	None
1	1 or 2
2	3 or 4
3	5–8
4	9–16
5	17–32
6	33–64
7	65–128
8	129–256
9	Over 256

There are, of course, many occupations in which the number supervised is largely meaningless. For the physician, the teacher, the minister supervisory responsibilities are unlikely to play any considerable part in their job. Furthermore, we encountered real difficulty in defining who is supervised by whom. Does a plant manager supervise the five or six people who report directly to him, or the 1000 people who work in the plant? There appeared to be a good deal of variability of interpretation among respondents, and the reports were sometimes quite ambiguous. At best, this criterion index can serve only as a supplementary indicator of achievement in certain of the occupations in which supervision is an important job function.

Self-Rating of Success and of Satisfaction. We felt that a man might be able to appraise his own achievement, relative to others in his own line of work, well enough to provide a useful supplement to reported income. Furthermore, job satisfaction is an aspect of suitability of job placement that is logically quite distinct from financial success in the job. For this reason, we asked each man to rate himself both with respect to success in his job and liking for the work he was doing. Unfortunately, the requirements of brevity and simplicity in our questionnaire instrument required that these ratings be kept down to a single question in each case, with four response options. The two questions, together with the four options, were as follows:

How well do you think you are performing in your present work?
  (1) Barely satisfactory.
  (2) About as well as average.
  (3) Better than average.
  (4) Outstandingly successful.
How well do you like the type of work you are now doing?
  (1) Dislike it.
  (2) O.K. It's a job.
  (3) Like it very much.
  (4) Better than any other.

In most occupational groups, we found that we got discouragingly little spread of response among these options. The typical choice was the third statement in each set, and this often accounted for 60 or 70% of the responses in the group. Recognizing that those variations in response that do occur are often reflections of optimism of temperament, or of tendency to mark extreme choices, we can hardly expect any marked relationships between this relatively crude measure and aptitude measures; in fact, few were found. Much more elaborate self-ratings would be required if reliable individual differences were to be established, which might in turn be expected to be related to predictor variables.

Vertical and Lateral Mobility. The criterion measures that have been described so far all refer to the *present* job. We wished to try to make some use of the complete job history, as reported by our respondents.

However, it did not seem practical to code and analyze each specific previous job. A more feasible and more rewarding approach seemed to be to make some synthetic appraisal of the record as a whole. This was accomplished by requiring the coders to make two judgments about each record. One judgment was of the amount of vertical mobility the individual had shown since leaving the Air Force; the other was a judgment of lateral mobility. These two ratings must be defined and illustrated more fully.

The appraisal of vertical mobility was designed to be an appraisal of upward progression in the occupational hierarchy. Coders were instructed to examine the work history and to compare the present job with the initial full-time job after leaving the Air Force. The comparison took account of increases in pay, responsibility, and standing of the two occupations. Rating was made in three categories: (1) little or no progress, (2) some progress, and (3) much progress. Several illustrations were provided for each level to serve as anchors for the coders' judgments. Illustrative examples are given on page 99 following the discussion of lateral mobility.

The coders were given practice upon a common sample of records for this rating (as well as for the rest of the coding), and were not permitted to code independently until their ratings were in substantial agreement with those of the coding supervisor. Although the ratings were subjective, we believe that they had substantial reliability.

Certain problems arose in rating the vertical mobility of those who had gone directly from school into one of the professions. In this case, there was little chance for the person to move from a lower level to a higher level job. Furthermore, he was unlikely to have supervisory responsibilities. About all there would be to go by would be current income, and even this was more often missing for self-employed professionals than for other groups. Our ground rules were that a person who was functioning as a self-employed person in one of the professions had reached a high occupational level, and that he should not be penalized because he had gone directly into this occupation. Thus, these individuals were generally rated as having shown much progress unless there was some indication that they were rather marginal members of the profession.

The rating of lateral mobility refers to the amount of shifting around from one type of job to another. Changes of job within the same specific occupation—i.e., from being a bookkeeper for one company to being a bookkeeper for a different company—were not considered to represent mobility. Mobility required a change in the type of job—i.e., from being a bookkeeper to being a salesman. Ratings were once again in the three categories of (1) little or no mobility, (2) some mobility, and (3) much mobility. Coders were trained in the use of this scale, as described above. Several examples follow, with the ratings given each, and the rationale for those ratings.

Example 1

1. Public administrator trainee	8/55–Present	N. Y. State	$341
2. Life insurance salesman	6/54–3/55	Insurance Co.	Commission
3. Civil engineering chainman	8/53–6/54	Construction	$300
4. Foreman	2/53–8/53	Aircraft Components	$370
5. Investigator	10/51–7/52	U. S. Government	$370

Rated: Low vertical mobility, because record shows little progress in job responsibility and no progress in income.

High lateral mobility, because record shows five jobs, each held only a short time, in quite different types of work.

Example 2

1. Mill recorder	10/49–Present	Steel	$495
2. Checker	2/46–10/49	Steel	—
3. Timekeeper	9/45–2/46	Steel	—
4. Inspector	6/45–8/45	Aircraft	$230

Rated: Moderate vertical mobility, because present reported income is more than double starting income.

Moderate lateral mobility, because the last three jobs that he has held are all basically clerical in nature, and has held present job for over 6 years.

Example 3

1. High school teacher (Mathematics)	9/55–Present	High school	$325
2. Railroad patrolman	6/48–8/55	Railroad	$390
3. Railroad ticket agent	3/45–6/48	Railroad	$300

Rated: Moderate vertical mobility, because of movement from service occupation to profession, even though no increase in income.

High lateral mobility, because three jobs reported are widely different in nature.

Example 4

1. Sales manager	7/53–Present	Soap	$850
2. Salesman	10/52–7/53	Soap	$600
3. Recalled, Korean War	2/50–8/52		
4. Salesman	11/45–1/50	Chemicals	$500

Rated: High vertical mobility, because of increase in both income and responsibility.

Low lateral mobility, because all three jobs involve selling the same type of product.

The rationale of vertical mobility as an index of success seems fairly obvious. The rating is a judgment that the person is getting ahead. The significance of lateral mobility may deserve a little comment. Ratings of lateral mobility provided an indication of how directly a person had settled down into a chosen occupation and how persistently he had pursued it. In the extreme, at least, a person who showed high lateral mobility could be considered an occupational drifter. He was a person who had shifted around from occupation to occupation and had not found a stable place in any. It seems reasonable to interpret this as representing poor occupational adjustment, and to consider this person as relatively unsuccessful.

Of course, lack of stability in a field of work may not represent poor adjustment in all cases. Changes may have been made for good reasons. Original choices may have been dictated by forces outside the individual's control, or may have represented poor guidance. Shifts may have been for the better, and the person may actually be well-adjusted and successful in his *present* field of work. However, inspection of the records suggests that this is not the usual state of affairs for the cases with high lateral mobility. It has seemed reasonable to us to consider those present members of an occupational group who have shown a large amount of lateral mobility in getting to their present position to be the ones who are less well adjusted to that occupation, and to use low lateral mobility as at least a supplementary measure of satisfactory adjustment in an occupation. On this rationale, the signs of all correlations with this variable were reversed and in subsequent discussion the variable will be referred to as *occupational stability*.

Length of Time in Present Occupation. Somewhat related to occupational stability is length of time in present occupation. Our coding of this took account of the consecutive period of time that a person had been in a particular occupation or in training for that occupation. Thus, a man who had entered engineering school in 1948 and who had worked as an engineer since his graduation would be recorded as having spent 7 years in the occupation as of 1 January 1956. (In the interest of uniformity 1 January 1956 was used as the terminal date for all cases.) Time in occupation does not, of course, give direct indication of how many or how drastic changes had taken place before the present occupation was entered. Thus in that sense it is less informative than the rating for lateral mobility.

Length of time in an occupation may possibly be considered an auxiliary criterion measure. In the case of the higher level occupations, at least, one could argue that the person who had entered the occupation early and who had made enough of a success at it to stay in it was the more successful man. This seems less clearly the case in lower level occupations, where success might be shown by moving up out of the occupation. Time in the occupation is of interest in any case for the light that it throws on the income criterion. Thus, if we found that test scores were related to income, but not to time in the occupation, we would have confidence that the relationship to income was a genuine one and not merely a reflection of time spent working.

CODING OTHER MATERIAL

Several other types of information were coded for possible use in later statistical analyses. However, these items were not actually used in any analyses. For this reason, we shall be content to list the items that were coded, without further elaboration.

A number of facts relating to each man's educational history were coded. They fell under the following headings:

(1) Highest level of educational program completed.
(2) Major field of study.
(3) Other education since World War II.
(4) On-the-job training received.
(5) Source of support for education.

Other items concerning the man's history since World War II that were coded included:

(1) Military service since World War II.
(2) Whether or not VA counseling had been received.
(3) Social security number.
(4) Supplementary comments, coded as to type of comment.

FORM OF MATERIAL AVAILABLE FOR ANALYSIS

The above items, together with testing number and army serial number, were punched on a single IBM punch card. The set of approximately 10,000 cards containing this information became one of the basic information-storing card decks from which working decks were prepared to be used in the actual statistical analyses. The basic record cards for each man were four in number.

(1) Name card, containing name, testing number, and army serial number.

(2) Questionnaire card, containing questionnaire data as described above.

(3) Test data card, containing scores on the 20 aptitude tests and in

addition various composite scores and other items of no current concern to us.

(4) Biographical Data Blank card, containing item responses to the 112 items of the Biographical Data Blank.

In addition to the data that it contained, each card also included either testing number or Army serial number or both as a basis for collating the different card decks. Two main working decks were prepared from this source material. One combined job grouping and criterion measures of job success from the questionnaire card with test scores from the test data card and was used in studying the relationship of test scores to job choice and job success. The other combined job grouping and reported income from the questionnaire card with item responses from the Biographical Data Blank card and was used to study the relationship of these item responses to occupational choice and success. The manner in which these analyses were carried out and the types of statistics that were computed are described in the following chapter.

Table 6.1

Final Combination of Jobs into Occupational Groups

Identification Code	DOT Codes Included	Job Titles	No. of Cases
010	000100	Unemployed	70
020	001100	Students	61
030	001 (all)	Accountants and auditors	239
040	002 (all)	Dramatic entertainment	8
	069210	Radio, TV announcers	9
	097750		
050	003 (all)	Architects (including landscape)	52
060	004 (all)	Artists	5
	043	Decorators, window dressers	6
	044	Commercial artists	39
	046	Designers	23
	056	Photographers	20
	577110	Glazier artist	1
	039010	Curator, art gallery	1
070	006 (except 006970)	Writers (except public relations men)	54
071	006970	Public relations men	76
080	007	Chemists, physical and earth scientists	111
	035610 ff.		
	098240	Mathematicians	

Table 6.1 *(Continued)*

Identification Code	DOT Codes Included	Job Titles	No. of Cases
081	035010 up to 035360	Biological and agricultural scientists	47
	039030	Curator, museum natural history	1
082	036	Social scientists	65
090	008	Clergymen	32
091	027	Social and welfare workers	18
	032030	Teacher of mentally deficient	1
100	011500 011700	College professors	72
101	023200	Librarian	49
	031010 031011 031012	High school teacher English, social studies, language	
102	031013 031014	High school teacher science, mathematics	78
	012200	County agriculture agent	
103	031100 099320	High school principal Academic administrative officer	65
110	013	Dentists	44
111	026	Physicians	45
112	034	Veterinarians	11
113	039900	Chiropractors, chiropodists	29
	052010 052220	Physical therapists, nurse	
120	014 015 020110	Engineers, metallurgical, chemical, and petroleum	85
121	016	Engineers, civil	130
122	017	Engineers, electrical	125
123	018	Engineers, industrial	132
	039940 069970 069980	Clerical technician, systems engineer	10
124	019 020	Engineers, mechanical, aeronautical, welding, agricultural, mining	300
125	014999–020999	Engineer, sales	132
	039970	Manager, technical service	
	069900	Safety engineer	4
126	0685 0686	Specifications writers and estimators	101

Table 6.1 ***(Continued)***

Identification Code	DOT Codes Included	Job Titles	No. of Cases
130	022 (all)	Lawyers, judges, etc.	215
	069840	Contract clerk	
	069870	Escrow officer	
	068450	Abstractor	
	068480	Law clerk	
	068460	Title searcher	
140	024	Musicians	8
150	025	Pharmacists	46
151	039920	Optometrists	35
152	050 (all)	Laboratory technicians and testers	45
	06666, 67		
	441920	Pulp tester	
	452760	Pilot control operator	
160	030110	Teachers, elementary	64
161	031015–19	Teachers, high school, other	155
	032300	Vocational, etc.	22
	05721, 41, 52	Coach, athletic instructor	
170	039810–039870	Personnel and employment managers	67
171	0687	Industrial relations specialists	42
180	041	Airplane pilot	130
190	048	Draftsmen	159
200	061	Control tower operators, dispatchers, and radio operators	25
210	064	Surveyors	10
220	065	Undertakers	14
230	071	Manager, hotel, restaurant, bar, tourist camp	66
	22330		
231	072	Manager, retail store, service station	514
232	073	Wholesaler	84
233	074	Buyer, department manager (retail store)	59
	075	Floor manager	3
234	091	Purchasing agent, broker, commodity buyer	97
235	09851, 09854	Manager, service or recreation establishment	102
240	081	Advertising agents	38
250	085	Credit manager	41
251	09801, 5, 8, 13	Manager, financial institution	55
252	09807, 10, 11	Manager, insurance	80
260	07901, 2, 5	Minor officials and agents	49
	094, 095		
270	09701, 2, 3	President, vice president, or secretary of company	164
271	09704, 5	Treasurer or comptroller	44

Table 6.1 *(Continued)*

Identification Code	DOT Codes Included	Job Titles	No. of Cases
272	09712, 13	Office manager, chief clerk	134
273	09741 09745 09747	Manager, industrial Manager, branch Manager, service	201
274	09751	Manager, production	106
275	09761, 2, 4	Manager, sales and promotion	264
276	09765, etc.	Manager, miscellaneous administrative	75
280	09756, 7 09831, 2, 3 09905, 11, 12 62, 65	Managerial, directing production	79
281	09921	Contractor	155
290	09862 to end 09766 09972 09992	Managerial, transportation and warehousing	79
300	10102 10103 and many others	Accounting record work	146
310	10141 10142 and many others	Material and production record work	131
320	10401 11007 11202 and many others	Communication and classification record work	171
330	11204 11206 11501 and many others	Public contact work	97
340	12526 12564 12567	Clerical machine operators	15
350	152 161600	Manufacturers' agent, broker, buyer	49
360	1571, 2	Insurance salesman, special agent	169
361	1573	Insurance underwriter	27
362	1574, 5	Insurance claim adjuster, investigator	58
370	163	Real estate salesman, broker	80
380	165	Salesman, securities	29
390	170, 175, 180	Sales clerks, sales persons, salesmen general, retail	69

Table 6.1 *(Continued)*

Identification Code	DOT Codes Included	Job Titles	No. of Cases
400	18501 1854	Salesman, wholesale clothes, dry goods, notions	44
401	1852 18532	Salesman, wholesale food, beverages, tobacco	90
402	1853	Salesman, wholesale chemicals and pharmaceuticals	55
403	1872	Salesman, wholesale publications and advertising	34
404	1873, 1875	Salesman, wholesale financial and transport services	10
405	1855, 6, 8	Salesman, wholesale household hard goods	172
406	18504, 11 1860, 1, 2, 3, 4	Salesman, wholesale industrial hard goods	206
410	221–248	Miscellaneous personal service occupations	38
420	261, 2	Guards and watchmen	11
430	263	Firemen	65
440	265, 6, 7	Policemen, detectives, sheriffs, bailiffs	116
450	306	Farmer, farm manager, general	183
451	301–309 except 306	Farmer, specialized	107
452	338, 340, 341	Other agricultural specialties	28
460	475, 6	Machinists, all around	109
461	478, 584	Machine shop specialists (i.e., operators)	65
470	Many in 6's and 7's	Production fabricating machine operators	44
480	Many in 4's and 6's	Production processing machine operators	45
490	444010 445010 etc.	Printing craftsmen	46
491	448010 448050	Printing pressmen	14
500	475120, 130	Handicraftsmen, machines and instruments	12
501	471010, 510	Handicraftsmen, jewelry and watches	18
502	432, 517	Handicraftsmen, cabinetmaking	26
503	Many in 4's	Handicraftsmen, other	44
510	Various 700's 702's, and 503's	Production assemblers	30
520	580, 581	Mechanics, engines	96
521	578100 583641	Mechanics, machines and production equipment	55
522	580120 581510 583621	Mechanics, vehicular and structural equipment, ordinance	44

Table 6.1 *(Continued)*

Identification Code	DOT Codes Included	Job Titles	No. of Cases
523	583040 583023 583461	Mechanics, appliances and cameras	16
524	583111 126 127	Mechanics, office machines	17
525	Various 572's	Mechanics, engines, boilers, kilns	17
530	497010, 20	Electrical, structural wiring	87
531	4979, 5839 etc.	Electrical, equipment and instruments	86
532	551 595320	Electrical, power systems	20
533	533010 thru 553371	Telephone installers	83
534	553420 thru 553965	Linesmen, cablemen	23
535	583411 583477	Radio and TV	33
540	525, 579 759	Carpenters, floor layers, lather	97
541	524	Bricklayers, tile setters, etc.	15
542	526, 527 529, 533	Cement finishers, plasterers	9
543	480	Sheet-metal workers	30
544	530	Pipefitters and plumbers	42
545	527010 716210	Painters	30
550	521010 574020 575050	Miners and petroleum drillers	10
560	483, 484	Steel workers	16
561	485, 495	Welders, lead burners	28
570	536, 736	Bus and truck drivers	92
571	541, 542, 544	Railroad engineers and trainmen	38
572	573, 588	Crane operators, etc.	12
573	723	Earth movers	14
580	655060 772540 etc.	Pumpmen and related	10
590	Various 8's and 9's	Laborers	55
600	591–599	Foremen	161

CHAPTER 7

Plan of Statistical Analysis

The data obtained in our study lent themselves to a variety of statistical analyses. The simplest, and in a sense the most basic, was comparison of the profile of mean test scores of each occupational group with the means for the total population from which the men came. The second major type of analysis was correlation of test scores within each occupational group with the criterion measures that provided some appraisal of occupational success.

Paralleling these analyses of test scores were similar analyses of the item responses on the Biographical Data Blank. Thus, on the one hand, the item responses of single occupational groups were compared with those for the total group of respondents to see which items differentiated a given group from the larger population; on the other hand, the upper and lower halves of each occupational group in reported earned income were compared item by item to identify items that were related to this criterion of success.

In addition to these basic patterns of analysis, some special treatments were undertaken in specific cases. The most ambitious of these was a multiple discriminant analysis of a subset of 22 of the groups to determine the extent to which the groups could be distinguished with respect to the test scores, and the number of dimensions necessary to express this discrimination.

Assistance in carrying out the statistical analysis was received from several sources, and we are happy to acknowledge this very valuable help. Most of the basic machine records and computing work was done at the Institute of Psychological Research, Teachers College, Columbia University, under the direction of Dr. Irving Lorge. The International Business Machines Corporation graciously made available computing time on the IBM Electronic Data Processing Machine 704 and computed most of the sets of validity coefficients and regression weights. The balance of the computation of correlation matrices and regression weights, together with all the computations involved in the multiple discriminant analysis, was carried out at the Educational Research Corporation, Cambridge, Massachusetts, under the direction of Dr. Phillip J. Rulon.

In this chapter we shall describe in some detail the statistical analyses that were carried out, and will discuss the issues that were faced and the decisions that were made in response to each. The several types of analysis will be considered in turn.

OCCUPATIONAL PROFILES

The first and simplest analysis to be made was to compute the mean score for each occupational group for each of the 20 measures that were included in the Aviation Cadet battery. Raw score means would have had no meaning since they would not have been comparable from test to test; so the raw score values were converted to standard scores with a mean of zero and a standard deviation of 100. Thus, a converted score of +50 signified a score one-half a standard deviation above the mean of the basic reference group.

The reference group for all the group tests was the total population of about 75,000 men tested with the battery of July 1943.*

Occupational group means were converted by the formula

$$C = 100\left(\frac{M_{OG} - M_T}{S_T}\right)$$

where C = the converted or standard score,

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*Score distributions and summary statistics for this population are available in the Technical Appendix of the final report on the Air Forces Personnel and Training Center Contract AF 18(600)-372, entitled Development of Methods for the Utilization of Wartime Classification Test Records in Personnel Research, dated 28 July 1954.

where M_{OG} = the raw score mean of the occupational group,
M_T = the raw score mean of the total reference group,
S_T = the raw score standard deviation of the total group.

The standard scores that resulted from the above transformation refer to the total Aviation Cadet examinee population. As indicated in Chapter 4, the Aviation Cadet examinees were quite a select group, so that standard scores in relation to this group do not give a clear picture of the individual's status relative to the general adult population. Some thought was given to trying to report occupational profiles with reference to the general adult population. This would have involved estimating the amount by which the cadet sample surpassed the general population on each of the tests, in standard score units, and adding this amount to each standard score based on the cadet sample. However, this idea was abandoned for two reasons. In the first place, the evidence on which we would have had to estimate the difference between cadet means and population means seemed too fragmentary to permit confidence in the corrections. In the second place, much of the use of test results in guidance is with the high school seniors, preparatory school pupils, and college students. These groups probably resemble the cadet group more than they do the general population, and for these groups the cadet norms may represent a more meaningful base of comparison.

In order that the user who is interested in doing so may make some adjustment of the standard scores that are reported in this book, estimates of the extent to which cadet applicant means surpass the general population mean are provided in Table 7.1. These estimates are based primarily upon results from testing with both the Aircrew Classification Battery and the Airman Classification Battery,* a sample of 3393 airmen all of whom had had exactly 12 years of education. This testing was carried out by the Air Forces Personnel and Training Research Center in 1952 and used the test batteries in effect at that time, so that some of the tests in the July 1943 battery were not represented. However, these data appear to provide the best bridge from the cadet group to a broader and more representative population.

If one accepts the enlisted airman norms as corresponding to the general adult population, the relative performance of the bridging sample on the airman and cadet tests provides a basis for estimating the amount that the cadet population was superior to adults in general. Thus, there is a Mechanical Principles Test included in both the air-

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*The aircrew battery was developed for Aviation Cadets, whereas the airman battery was developed for and normed on the general population of Air Force enlisted men.

Table 7.1

Estimates of Cadet Means and Standard Deviations Relative to General Population Parameters

	Cadet Mean in Population Standard Deviation Units	Ratio of Cadet to Population Standard Deviation
Reading Comprehension	+1.37	0.72
General Information—Navigator	+1.37	.72
Mathematics	+1.31	.76
Arithmetic Reasoning	+1.31	.76
Numerical Operations I	+0.78	.84
Numerical Operations II	+0.78	.84
Dial and Table Reading	+0.91	.70
Speed of Identification	+1.12	.87
Spatial Orientation I	+1.12	.87
Spatial Orientation II	+1.14	.80
Mechanical Principles	+1.08	.73
General Information—Pilot	+1.28	.70
Two-Hand Coordination	+0.70	.90
Complex Coordination	+0.70	.90
Rotary Pursuit	+0.50	.95
Finger Dexterity	+0.60	.95
Aiming Stress	+0.30	.95
Discrimination Reaction Time	+0.70	.90
Biographical Data—Pilot	0.00	1.00
Biographical Data—Navigator	+1.00	.80

man and the cadet battery. The bridging group received the following stanine scores.*

	Mean	S. D.
Airman test	7.12	1.57
Cadet test	4.93	2.15

Assuming that the general population mean is 5.00 on the airman test and that the general population standard deviation is 2.00, and assuming the same numerical value for the mean for cadet applicants on the cadet tests, we find that a cadet score of 5.00 corresponds to an airman score of 7.17, or that the average cadet is 1.085 standard deviations above the airman mean. By getting the ratios of the two standard deviations, we have an estimate that the cadet group is 0.73 times (i.e.,

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*Normalized single-digit standard scores in which the mean is equal to 5, and each score unit covers a range of one-half standard deviation.

1.57/2.15) as variable as the airman group that we are accepting as representing the general population.

Carrying out similar analyses for the other tests, using whatever test or combination of two or three tests in the airman battery best seemed to match a given test in the cadet battery, we arrived at the estimates in Table 7.1. These estimates are somewhat fragile at best, since they involve the assumption that the airman sample is representative of the general population and that the airman tests are comparable to the cadet tests. Those for the psychomotor tests are particularly fallible, since there were no motor tests in the airman battery. Values for the psychomotor tests had to be inferred from group tests having only modest correlations with the psychomotor tests. Recognizing that allowance must be made for a considerable margin of error, one may still use the values presented in Table 7.1 to provide some estimate of the level of performance of an occupational group in relation to the general population.

The procedure for making the type of estimate that we have been describing may be illustrated using the mean Arithmetic Reasoning and Numerical Operations scores of our group of 235 accountants and auditors. The means of this group, expressed in standard scores of the cadet groups were +36 for Arithmetic Reasoning and +55 for Numerical Operations I. We estimate the mean Arithmetic Reasoning score, referred to the general population, as follows:

$$+1.31 + (0.36)(0.76) = +1.56 \text{ S.D. units}$$

A similar estimate of the Numerical Operations mean gives:

$$+0.78 + (0.55)(0.84) = +1.24 \text{ S.D. units}$$

Thus we would conclude that those men who became accountants fell, on the average, more than 1½ standard deviations above the general population mean on a test of arithmetic reasoning, and about 1¼ standard deviations above on a test of simple numerical operations.

The reader who wishes to make this type of estimate for any of the occupational groups may readily do so, using Table 7.1 and the table in a later chapter giving the standard score profile for the particular occupation. However, one further caution should be given to those who would make such transformations. It must be remembered that our respondents consisted almost entirely of men falling above the general population mean. A good deal of selection had operated to eliminate in advance those who might have had low scores on the tests. For this reason, the sample available to us in many occupations was undoubtedly quite unrepresentative of all workers in the occupation. Thus, our group of bus and truck drivers had a mean standard score on the Reading Comprehension Test of -37. On the basis of Table 7.1, we would convert this into an estimated population standard score of $+1.37-(0.37)(0.72) = +1.10$. However, it seems quite absurd to conclude that the total group of truck and bus drivers in the United States falls more than a standard deviation above the generality of the population in reading comprehension. Group differences have been minimized, and in a measure distorted, by the preliminary selection of our total group. Translation of occupational group means into values referred to the general population is probably most meaningful for the more selective occupations, and certainly has very little meaning for the unskilled, semi-skilled, and even perhaps the skilled and clerical occupations.

TEST VALIDITY COEFFICIENTS

The computation of validity coefficients, regression weights, and multiple correlations of all the test variables against all the job success measures was duly completed. Significance tests were then applied to determine what proportion of the validity coefficients reached significance at the 0.05 level. The proportion was found to be discouragingly small. Each occupational group yielded 140 coefficients (20 tests and 7 criterion variables). Thus, if these were independent observations, we should have expected by chance that an average of 7 of them would be large enough to be significant at the 0.05 level. There were many of the occupational groups for which the number was *no* greater than this, and the average number was not much greater.

Furthermore, for a number of groups we found as many "significant" negative correlations as positive ones. Low test score tended to go with high criterion score. Relationships of this sort are very difficult to rationalize. It is hard to understand how high test performance can be logically and meaningfully related to low success. Certain of the most striking relationships were of this sort. Thus, we found a "significant" *negative* relationship between Finger Dexterity and income as a dentist!

One further finding was a rather general lack of clustering in the significant relationships. When a test showed a significant correlation with one of the seven criterion measures, it rarely showed similar correlations with any of the other six. When one of a set of related tests showed a significant correlation, it was exceptional if the other tests of the set did also. When a significant correlation was obtained for one of a number of related jobs, it was not common to find other significant correlations for that same test for the other related jobs.

All of these outcomes were quite discouraging! We were reluctantly forced to conclude that the simplest and most defensible interpretation for our results was that the 12,000 correlations could all be thought of as chance deviations from a population value of zero. There was no convincing evidence to force us to reject the null hypothesis. It is not quite true to say there was *no* evidence. There was some slight excess of correlations significant at the 0.05 level. But the excess was so slight and the proportion of the "significant" correlations that could have been explained by chance so high that any attempt to decide which ones were "really significant" seemed quite futile.

Perhaps this result should have been anticipated. The factors tending to camouflage and suppress significant results in our data were many. In particular, our criterion measures were fallible in many respects. Certainly, our results should not be interpreted as meaning that tests can never have value as predictors of success in a specific occupation within a specific company. But they give no encouragement to the belief that a counselor in school or college, knowing only the scores and knowing nothing about the situational factors in the job that the man will fill, can make any prediction of later job success.

Because of the essentially negative character of our correlational results, we have not included the 12,000 correlations in this report. For the person who wishes to examine them, these results are on file with the American Documentation Institute as Document 5821.

BIOGRAPHICAL DATA ITEM RESPONSES

We had available for each man his responses to a Biographical Data Blank. The actual items are reproduced in Appendix A. This blank nominally was made up of 65 items. However, the number of discrete responses made by the individual was substantially more than this, since on items 55 to 65 he could respond by marking any responses that applied. Thus, he could indicate participation in any of 15 hobby activities or any of 20 work activities by multiple responses to 7 numbered items. In addition, he could report participation in any of 5 pre-aviation activities, report any of 5 categories of relatives as licensed pilots, and subscribe to any of 10 reasons for having sought Aviation Cadet training.

The men in each occupational group were divided into three categories: (1) those who did not report earned income, (2) those who were in the upper half on earned income, and (3) those who were in the lower half on earned income.

The number of cases in the upper and lower group were made equal, and if necessary to achieve equal numbers, tied cases were assigned at random to the upper and lower groups. In addition to the count for the three subgroups, the frequencies of each response were obtained for the total group in each occupation and for the total group in all occupations.

For each occupational group, the initial tabulation gave the percentage of the group choosing each of the possible alternatives to each of the items. All items were reduced to dichotomies before any further analysis. When an item had five possible responses, the alternatives were grouped before comparing the responses of the occupational group with the base rate for the total group of respondents. Thus, only a single significance test was carried out for a single item. The percentage choosing the item in the occupational group was compared with the percentage for respondents-in-general. A facilitating table was prepared, based on number of cases in the respondent group and the percentage split on the item, to aid in identifying differences significant at the 0.10, 0.05, and 0.01 level. In these significance tests, it was assumed that the error for the group of approximately 10,000 respondents-in-general could be ignored.

In each of the later chapters, tables are presented indicating all the items on which the group differed from respondents-in-general at the 0.10, 0.05, and 0.01 levels of significance. The following symbols are used to indicate the size and direction of differences.

Significant at	Occupational Group More Than Respondent Population	Occupational Group Less Than Respondent Population
0.10 level	+	−
0.05 level	+ +	− −
0.01 level	+ + +	− − −

Tables were prepared for those occupational groups that showed more significant items than could readily be attributed to chance. Most groups showed some excess of significant items, and some showed a great many that were significant.

In addition to the analyses comparing each occupational group with respondents-in-general, comparisons were made of the upper income and lower income group within the same occupation. These provided an index of item validity against the criterion of reported income. However, none of the results from these analyses is reported here. The number of significant differences was little if any greater than the number that could have occurred purely by chance, and so no detailed presentation or interpretation of these results seemed merited. Just as the tests failed to show enough evidence of validity to justify interpretation, so also the biographical data items failed to give any convincing evidence of their ability to predict occupational success.

MULTIPLE DISCRIMINANT ANALYSES

Multiple discriminant analysis* attempts to identify in a set of predictors that weighted combination that will most sharply discriminate among a number of defined groups. A second weighted combination is then sought, uncorrelated with the first, that will provide the maximum amount of further discrimination. Further discriminants may be sought until the variance among groups becomes too small to be statistically significant.

The procedure for this analysis is described somewhat more fully in Chapter 26, in which the results from applying the technique to 22 occupational groups are reported.

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*See Tatsuoka, Maurice M. and David F. Tiedeman, Discriminant analysis, *Review of Educational Research*, 1954, 24, 402–420, for a review of this and related techniques.

PART III

CHAPTER 8

Treasurers and Comptrollers, Accountants and Auditors, Managers of Financial Institutions

This chapter reports test score profiles and biographical item responses for three related occupational groups. The first is a group of treasurers and comptrollers of business concerns. The second is a group of accountants and auditors working in a wide range of specific situations and jobs. The third is a group of managers of financial institutions.

DEFINITION OF GROUPS

Treasurer or Comptroller. This group corresponded to two DOT code categories, 0–97.04 and 0–97.05. These 44 individuals worked in many different types of companies, in which they were responsible for general control and management of financial operations. They reported an average earned income of $734 per month, with a standard deviation of $388. The average time working in the occupation was slightly less than 7 years.

Accountant or Auditor. These men worked in the many different accounting specialties covered under the DOT code 0–01. Included were cost accountants, general accountants, public accountants, tax accountants, and auditors. The group included both certified public accountants and those not certified. The average income reported by the 235 men was $544 a month with a standard deviation of $184. On the average, the men had worked in this occupation for a little over 6 years.

Manager of Financial Institution. The men in this group were primarily bank managers and bank cashiers, though they also included a few credit analysts and trust officers. Thus, the four DOT categories were 0–98.01, Bank Cashier; 0–98.05, Credit Analyst; 0–98.08, Manager of a Financial Institution; and 0–98.13, Trust Officer. All these individuals occupied relatively important and responsible positions in banking, and it was felt that they dealt with money and financial policies in somewhat the same ways that the members of the other two groups did. The mean monthly income reported by the 55 members of this group was $581 with a standard deviation of $252. The average length of time in the occupation was not quite 7 years.

GROUP MEAN SCORE PROFILES

Table 8.1 shows the mean standard score on each test for each of these groups. The tests have been arranged so that those emphasizing verbal ability come first, followed by those emphasizing numerical skills. These are followed in turn by tests emphasizing perceptual speed and tests involving mechanical understanding. Then there appear tests of motor coordination, followed finally by the two scores from the Biographical Data Blank. It will be noted that the profiles for these groups had a substantial amount of similarity. Rank difference correlations between the three profiles yield the following values:

Treasurers and comptrollers vs. accountants and auditors	0.92
Treasurers and comptrollers vs. managers of financial institutions	0.62
Accountants and auditors vs. managers of financial institutions	0.65

At the cost of some detail, the profiles can probably be somewhat better grasped by grouping together sets of related test variables. Five composite scores have been produced by a crude unweighted pooling of variables. The pooled score composites have been put into the same metric (mean = 0, S.D. = 100) that was used for the single tests. The designations of the composites, and the variables that have been pooled to make each are as follows:

General intellectual–Reading Comprehension, General Information—Navigator, Mathematics, Arithmetic Reasoning.

Numerical–Numerical Operations I and II, Dial and Table Reading.

Perceptual-spatial–Speed of Identification, Spatial Orientation I and II.

Table 8.1

Mean Standard Score Profile for Treasurers and Comptrollers, Accountants and Auditors, and Managers of Financial Institutions

	Treasurers and Comptrollers	Accountants and Auditors	Managers, Financial Institutions
Reading Comprehension	30	3	4
General Information—Navigator	47	20	−2
Mathematics	50	29	6
Arithmetic Reasoning	43	36	11
Numerical Operations I	80	55	29
Numerical Operations II	79	48	36
Dial and Table Reading	79	31	17
Speed of Identification	16	−7	−13
Spatial Orientation I	30	6	2
Spatial Orientation II	8	−9	−15
Mechanical Principles	−21	−37	−36
General Information—Pilot	3	−31	−17
Two-hand Coordination	−1	−11	−22
Complex Coordination	10	−11	−15
Rotary Pursuit	5	−8	13
Finger Dexterity	3	9	−8
Aiming Stress	−4	−32	3
Discrimination Reaction Time	27	9	8
Biographical Data—Pilot	−48	−55	−17
Biographical Data—Navigator	18	3	30
N	44	235	55

Mechanical-Mechanical Principles, Biographical Data—Pilot, Two-Hand Coordination.

Psychomotor-Complex Coordination, Rotary Pursuit, Finger Dexterity, Aiming Stress.

For our three occupational groups, the profiles on these composites are as follows:

	Treasurers and Comptrollers	Accountants and Auditors	Managers, Financial Institution
General intellectual	55	28	6
Numerical	96	54	33
Perceptual-spatial	23	−4	−11
Mechanical	−31	−46	−33
Psychomotor	5	−16	−3

We see that the ablest group was the group of treasurers and comptrollers, followed by the accountants and auditors, with the managers of financial institutions coming last. All three groups had their highest score on the numerical composite and their next to highest on the general intellectual composite. All were lowest in mechanical ability. The treasurers and comptrollers showed the sharpest differentiation of scores, and the financial managers least. All the groups were average or above on the numerical and general intellectual composites, and all were below average in mechanical ability.

A table like the one just discussed, which shows only the group means, is likely to be misleading, because it does not portray the variation within each group. Figure 8.1 has been prepared to bring out this point. In this figure, the results for the treasurers and comptrollers are shown. However, in addition to showing the means on each of the five score composites, the figure also shows a range of plus and minus one standard deviation from this mean. The means are shown by the heavy vertical bars, and the ±1 S.D. range by the arrow points.

Figure 8.1 brings out quite clearly the wide range within the group. (The standard deviations do not differ greatly from the population value of 100.) The overlapping for different test composites is quite noticeable. Thus, even though the numerical and mechanical means

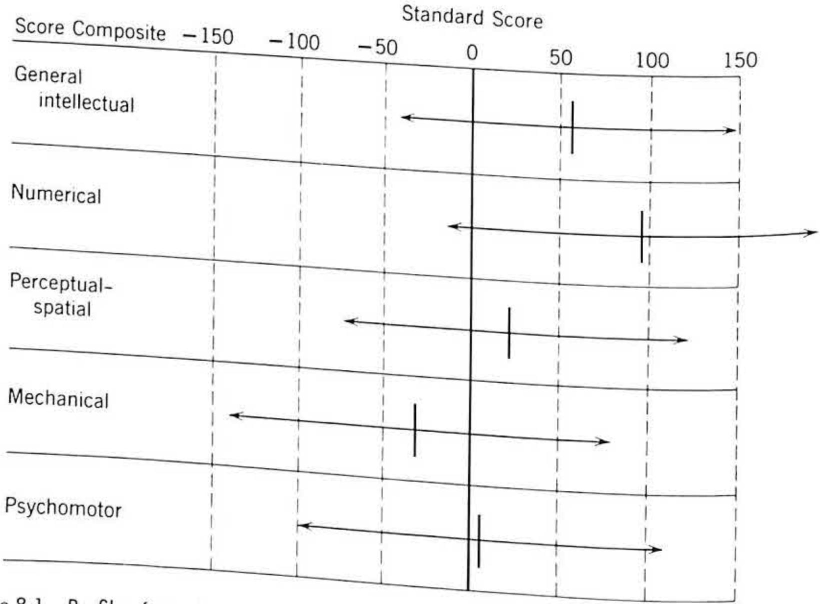

Figure 8.1 Profile of standard scores for treasurers and comptrollers on test composites. (Vertical bar shows mean; arrow heads show ±1 S. D.)

differed by 127 on our standard score scale, these two composites overlap, and it would be quite possible to find a treasurer who had done better on the mechanical than on the numerical tests. With less extreme separations of the means the overlap is even more marked.

This figure emphasizes the caution that needs to be exercised in interpreting profiles based on group means. Even though differences may be not only statistically significant but also descriptively quite marked, there will be individual members of the group who reverse the usual pattern.

BIOGRAPHICAL DATA ITEM RESPONSES

As indicated in Chapter 7, some 112 experimentally independent item responses on the Biographical Data Blank were analyzed. Each was treated as a dichotomy, even though the original item responses in some cases permitted five options differing in level or degree. For presentation the items have been grouped into clusters dealing with a common or related type of situation. Eight clusters of items were assembled from the blank, dealing respectively with

(1) General family and personal background.
(2) Major subject of study in college, if college attended.
(3) Success with different school subjects.
(4) Sports participation and skill.
(5) Miscellaneous activities engaged in.
(6) Hobbies.
(7) Work experiences.
(8) Reasons for seeking Aviation Cadet training.

The item responses for each group are summarized in tabular form in Table 8.2. The table shows *plus* and *minus* activities. Plus activities are those in which the group fell significantly above the total Cadet population in level of skill or frequency of participation, and the minus activities are those in which the group fell significantly below par.

Three levels of significance are shown. Differences large enough to be significant at the 0.01 level are marked + + + or − − −; those significant at the 0.05 but not the 0.01 level are marked + + or − −; those significant at the 0.10 but not the 0.05 level are marked + or −. Only those items are listed that were significant for some one of the three occupations.

A substantial number of the Biographical Data Blank responses showed significant differences for these groups. In all, 112 separate

Table 8.2
Biographical Data Blank Item Responses Differing Significantly* from Population Values

Item	Auditors, Accountants	Treasurers, Comptrollers	Manager, Financial Institutions
General Family and Personal Background			
Many tools in the home	–		
Had some college education	+ +	+ + +	
Father graduated from high school			+
Father of American stock	–		+ +
Mother of American stock	–		
Duration of interest in aviation career	– – –	– – –	
Family owned expensive car	– –		+ +
Has driven or ridden motorcycle	– – –	– – –	–
Major Subject in College			
Did not attend college	– –	– – –	– –
Education	–		
Business, commerce, journalism	+ + +	+ + +	
School Subjects Studied and Done Well			
Algebra	+ + +	+ + +	+
Economics	+ +	+ + +	
English		+ +	
Foreign languages		+ +	
Mechanical drawing	– – –	– – –	– –
Physical training	– –		
Physics	– –	+ +	
Shop work	– – –	– – –	– –
Trigonometry		+ +	
Sports Participated in and Done Well			
Football, rugby, soccer	– –	– – –	
Boxing, wrestling, water polo	– – –	–	
Crew, rowing, canoeing	– – –		
Tennis, handball, ping-pong, badminton			+
Diving, ski jumping	– –	– –	
Marksmanship	– – –	–	
Sailboating	– –		+ + +
Auto, motorcycle, motor boat racing	– –		
Swimming		– – –	

*Code is as follows:

– or +	significant at 0.10 level.
– – or + +	significant at 0.05 level.
– – – or + + +	significant at 0.01 level.

Table 8.2 (*Continued*)

Item	Auditors, Accountants	Treasurers, Comptrollers	Manager, Financial Institutions
Track (longer races)	– –		
Horsemanship	– – –		
Activities Done a Number of Times			
Sell article to customer			+
Write essay or poem			+ +
Interview men for job		+ +	
Arrange flower garden			– –
Make a speech			+ +
Adjust carburetor	– – –		– –
Hobbies and Free-time Activities			
Painting, sketching	– – –		
Journalism, school paper			+ +
Photography	–		
Woodworking, cabinetmaking	– – –		–
Sheet-metal work	– – –	– –	–
Metal work, machine shop	– – –	–	
Auto repair, rebuilding	– – –		
Build powered model plane	– –		
Work Experience			
Semi-skilled manual		–	
Skilled manual	– – –	– –	
Minor supervisory	– –		
Engineering, drafting, surveying	– – –	–	
Simple clerical	+ + +	+	+ + +
Higher office work	+ + +	+ + +	+ + +
Sales—auto, real estate, etc.		– –	
Managerial			+
Academic			+
Instructor or leader	– – –	+ + +	
Semi-professional	– –		
Reporter, lawyer, advertising	–		
Entertainer	– – –		
Protective service	– –		
Social service		+	
No work experience			– –
Reason for Choosing Cadet Training			
Love of adventure	– –		
Feel have aptitude		+	
To prove can make good	– – –		

responses were tallied. The number of these on which the three groups differed significantly from cadets-in-general were:

	0.01 Level	0.05 But Not 0.01 Level	0.10 But Not 0.05 Level
Treasurers, comptrollers	15	9	8
Accountants, auditors	25	16	6
Managers, financial institutions	3	11	9

For all three groups, the number of significant differences was in excess of chance, and for the first two groups it was markedly so.

The items for the treasurers and the accountants fell in general into a consistent pattern and one that was similar for the two groups. The men tended to have had more than an average amount of education and to have majoring in business. They had been successful in college preparatory subjects, but had either not taken or not done well in mechanical drawing or shop work. They had frequently engaged in office and clerical work before entering the Air Force, but relatively seldom in skilled manual or technical jobs. They were low on several activities of a mechanical nature, and fell below average in successful participation in a number of sports, especially those involving hazard or body contact. They had less of a background of interest in flying. Thus, they appeared clerical-quantitative and nonmechanical in their activities as well as in their test scores.

The pattern for men who became managers of financial institutions was less marked and clear-cut. There was some indication that these men started off with cultural and economic advantages. They showed an excess of American stock, of expensive automobiles, and of sailboating. They were not significantly different from the total group in most sports, but did show a few deficiencies in the mechanical area. On the other hand, they were high on several verbal and social contact items. Like the treasurers and the accountants, they showed a high percentage of participation in clerical and office work.

SUMMARY

In this chapter we have presented the findings for three occupational groups: treasurers and comptrollers, accountants and auditors, and managers of financial institutions. The results for each group will be summarized briefly below.

Treasurer or Comptroller. The men in this group were very high on numerical tests, quite high on general intellectual measures, but below average on mechanical tests. Biographical item responses showed the group to be high on items relating to academic success and to office and clerical work, but low on items having to do with mechanical devices or physical activity.

Accountant or Auditor. The score pattern for these men was much the same as for the previous group, though all scores averaged somewhat lower. The general picture of a group strong in academic and clerical activities, but quite nonmechanical and nonathletic appeared here also.

Manager of Financial Institutions. Somewhat the same pattern of high numerical and low mechanical scores was repeated in this group, but the differences were less marked and the average level of scores was lower. The biographical items did not exhibit a very clear pattern, but there was a suggestion of superior home background, high participation in verbal and social activities, together with some deficit in the mechanical items.

CHAPTER 9

Visual and Verbal Professions

In this chapter we present data on five professional groups. Two which seem "visual" in character are architects on the one hand and artists and designers on the other. Three which seem primarily "verbal" are lawyers, writers, and public relations men.

DEFINITION OF GROUPS

Architect. The group embraced the DOT codes 0–03.10, Architect, and 0–03.20, Landscape Architect. However, only one or two landscape architects were included in the group of 52, so that basically it was a rather homogeneous occupational grouping. The average monthly income for men in the group was $671, with a standard deviation of $406. The large standard deviation indicates that there were one or two men with very large incomes. Average time in the occupation was about 7½ years.

Artist or Designer. This was quite a varied group. It included men in a wide variety of jobs based in some way on visual or graphic arts. Some of the titles and codes that appeared in this group were the following: 0-43.40, Interior Decorator; 0-44.21, Commercial Artist; 0-44.28, Art Director; 0-46.88, Industrial Designer; 0-56.11, Photographer, commercial. Average income for men in this group was $599 with a standard deviation of $247. The average length of time in this occupation was also about 7½ years.

Lawyer. The third grouping consisted of occupations concerned with law. The vast majority of the 226 men in the group were in the DOT code 0-22, which covers all types of lawyers, district attorneys, and judges. In addition, the group included a few persons in such occupations as 0-69.84, Contract Clerk; 0-69.87, Escrow Officer; 0-68.45, Abstractor; 0-68.48, Law Clerk; and 0-68.46, Title Searcher. Average monthly income was $648, with a standard deviation of $269. On the average, the men had been in the occupation for about 6 years.

Writer. A fourth group was made up of all types of writers, except public relations men. Writers are classified 0-06 in the DOT. Some of the specific occupations that appeared in this group of 55 men were 0-06.25, Radio News Editor; 0-06.44, Editor of a Department; 0-06.53, Trade or Technical Editor; 0-06.73, Columnist; 0.06-90, Writer for Technical Publication; 0-06.94, Copy Writer. In general, there were many specific DOT codes represented, with only a few representatives of each. As can be seen from the DOT categories, the writing and editing tended to be of an expository, rather than a literary nature. It rewarded the members of the group with an average income of $538 per month, the standard deviation being $185. The men had been in the occupation for a little under 7 years, on the average. In view of the variety of specific occupations included under the general rubric "writer," we must recognize that this was a rather heterogeneous grouping.

Public Relations Man. Finally, there were enough men in our sample working in public relations, and this appeared sufficiently different from other verbal occupations to justify setting up a special grouping for 0-06.97, Public Relations Man. There were 78 men who fell in this category. As a group, they were somewhat better paid than the other writers, averaging $589 a month, with a standard deviation of $197. Average time in the occupation was somewhat over 6½ years.

GROUP MEAN SCORE PROFILES

The profiles for architects and artists and designers appear in Table 9.1. The distinctive feature in both these profiles is the peak in the tests involving speed and accuracy of visual perception. Both groups fell

Table 9.1
Mean Standard Score Profile for Architects and Artists and Designers

	Architects	Artists and Designers
Reading Comprehension	23	−4
General Information—Navigator	39	16
Mathematics	61	−12
Arithmetic Reasoning	12	−21
Numerical Operations I	−18	−21
Numerical Operations II	9	−13
Dial and Table Reading	19	5
Speed of Identification	50	45
Spatial Orientation I	59	37
Spatial Orientation II	61	35
Mechanical Principles	1	1
General Information—Pilot	28	18
Two-Hand Coordination	1	−3
Complex Coordination	29	4
Rotary Pursuit	2	10
Finger Dexterity	0	5
Aiming Stress	6	2
Discrimination Reaction Time	25	23
Biographical Data—Pilot	15	−7
Biographical Data—Navigator	15	−12
N	51	95

well above average on Speed of Identification, Spatial Orientation, and Discrimination Reaction Time. The architects were also high in mathematical information, as evidenced by scores on Mathematics and General Information—Navigator. Verbal score for the architects was somewhat above average. In part, the pattern may reflect the screening that occurs in educational programs for architects. There is some similarity between the two profiles shown in Table 9.1, as represented by a rank-difference correlation between them of 0.52.

The main features of the score profiles are brought out by the five score composites shown below:

	Architects	Artists and Designers
General intellectual	44	−7
Numerical	4	−12
Perceptual-spatial	74	51
Mechanical	8	−4
Psychomotor	14	8

Table 9.2

Mean Standard Score Profile for Lawyers, Writers and Public Relations Men

	Lawyers	Writers	Public Relations Men
Reading Comprehension	22	44	1
General Information—Navigator	33	57	20
Mathematics	41	7	11
Arithmetic Reasoning	25	22	−3
Numerical Operations I	17	1	12
Numerical Operations II	22	0	−8
Dial and Table Reading	15	−1	−3
Speed of Identification	−5	5	−11
Spatial Orientation I	−6	−7	4
Spatial Orientation II	−6	7	−2
Mechanical Principles	−30	−22	−31
General Information—Pilot	−10	2	2
Two-Hand Coordination	−22	−38	−17
Complex Coordination	−14	−30	−7
Rotary Pursuit	−14	−20	−7
Finger Dexterity	−11	−15	0
Aiming Stress	−17	2	−10
Discrimination Reaction Time	9	2	−14
Biographical Data—Pilot	−42	−53	−25
Biographical Data—Navigator	45	7	6
N	223	54	78

We see that both groups show a peak on the perceptual-spatial tests, while the architects also show a secondary peak in general intellectual ability. All of the architects' scores were somewhat higher than those for artists and designers.

Table 9.2 presents profiles for lawyers, writers, and public relations men. The profiles on the five composite scores are as follows:

	Lawyers	Writers	Public Relations
General intellectual	39	42	9
Numerical	22	0	0
Perceptual-spatial	−7	2	−4
Mechanical	−42	−50	−32
Psychomotor	−21	−24	−9

These three groups have the high and low points of their profiles in common. This community is shown by the following rank-difference correlations:

Lawyers vs. writers	0.78
Lawyers vs. public relations men	0.68
Writers vs. public relations men	0.57

The high point in each profile is the general intellectual composite and the low point is the mechanical composite. All three groups were noticeably deficient in mechanical ability and somewhat below average in psychomotor performance.

Turning to differences between the groups, we note that writers showed their strength specifically on the verbal tests. Lawyers also did fairly well on mathematics and number tests. The public relations men were definitely less able on the intellectual tests and showed a generally flatter profile than the other two groups. This group fell about at the average for the cadet population, except for the deficit in mechanical score. Thus, lawyers were good in intellectual and numerical ability, but poor in mechanical ability; writers were good rather specifically in verbal ability and poor in mechanical ability; public relations men were not outstandingly good anywhere, and were poor on mechanical measures.

BIOGRAPHICAL DATA ITEM RESPONSES

The items of the Biographical Data Blank on which the architects and the artists and designers differ significantly from the total cadet group are shown in Table 9.3. In response to these items, the two groups show some similarities, but also a number of marked differences.

The groups were similar in showing high participation or success in mechanical drawing in school and painting or sketching as a hobby. They were both low in the experience of adjusting a carburetor. That is, they showed graphic rather than mechanical interests. However, the

Table 9.3
Significant Biographical Data Item Responses for Architects and Artists or Designers

	Architects	Artists and Designers
General Family and Personal Background		
Lived mostly in the city		+ + +
Many books in the home		+ +
Had some college education	+ + +	
Father graduated from high school	+ +	+ +
Mother graduated from high school	+ +	
Mother of American stock		− −
Family owned expensive car		+

Table 9.3 *(Continued)*

	Architects	Artists and Designers
Major Subject in College		
Did not attend college	− − −	
Social sciences or philosophy	−	
Fine arts, music, architecture	+ + +	
Physical science, mathematics, engineering	+ +	
English, literature, drama		+ +
School Subjects Studied and Done Well		
Algebra	+ + +	
English		+
History		+
Mechanical Drawing	+ + +	+ + +
Trigonometry	+ + +	− − −
Sports Participated in and Done Well		
Crew, rowing, canoeing	−	+
Tennis, handball, ping-pong, badminton		+ +
Swimming		+ +
Activities Done a Number of Times		
Adjust clock	− −	
Arrange club entertainment		+ +
Write essay or poem		+ + +
Adjust carburetor	− − −	−
Hobbies and Free-Time Activities		
Painting, sketching	+ + +	+ + +
Creative writing		+ + +
Photography	+	+ + +
Auto repair, rebuilding	− − −	− −
Work Experience		
Unskilled manual		−
Semi-skilled manual		−
Skilled manual	− −	
Minor supervisory	− −	− −
Engineering, drafting, surveying	+ + +	
Simple clerical		−
Sales clerk, canvasser	+ + +	
Semi-professional	+	+ + +
Reporter, lawyer, advertising		+ + +
Reason for Choosing Cadet Training		
Love of adventure	+	

architects reported more college training and more success in mathematics. They had often had work experience in engineering and drafting, whereas the artists and designers showed an above average incidence of experience in subprofessional work (including photography) and in public relations (including advertising). The artists and designers tended to come from an urban background and to have linguistic and literary rather than quantitative and technical interests and experiences. The supplements to their visual and graphic skills and interests appeared to be quite different in the two groups.

Biographical Data Blank item responses for lawyers, writers, and public relations men appear in Table 9.4. The responses for these groups show many points of similarity. They all tended to come from homes well supplied with books. All showed an excess of men who had gone on to college. The pattern of school participation was similar, being high on dramatics, English, and foreign languages and low on mechanical drawing and shop work. They tended frequently to have arranged club entertainments or made speeches, but rarely to have adjusted a clock or a carburetor. Mention was frequently made of free-time activities of creative writing and journalism, but rarely of handwork or auto repairing and rebuilding. They tended to have worked at simple clerical work or in the public relations group (which included reporting, law, and advertising as specific examples). The collective picture supports that given by the aptitude tests of a verbal and nonmechanical group.

Some differences between the groups also merit attention. The lawyers showed a wider range of academic success, being high on algebra and trigonometry as well as verbal subjects. The lawyers tended to be urban in background and to have relatively well-educated parents, as did the public relations men. One suspects that law attracts more than its share of second generation professionals. The nonmechanical pattern was most clear-cut in the lawyer group, though this may be partly a reflection of the larger number of cases which makes smaller differences statistically significant.

SUMMARY STATEMENT

This chapter presents material on five occupations that we have labelled visual and verbal professions. By way of summary, we will give a brief thumbnail sketch of the ability and activity pattern for each.

Architects. These men showed a marked peak on perceptual-spatial tests, but were also well above average on general intellectual measures.

Table 9.4

Significant Biographical Data Item Responses for Lawyers, Writers, and Public Relations Men

	Writers	Public Relations Men	Lawyers
General Family and Personal Background			
Lived mostly in the city		+	+ +
Many books in the home	+ + +	+ + +	+ + +
Many tools in the home	− −		− − −
Had some college education	+ + +	+ + +	+ + +
Father graduated from high school		+ +	+ + +
Father of American stock		−	
Mother graduated from high school		+ + +	+ + +
Duration of interest in aviation career	−		+ + +
Family owned expensive car		+	
Is a good safe driver			−
Has driven or ridden motorcycle			−
Major Subject in College			
Did not attend college	− −	− − −	− − −
Social sciences or philosophy		+	+ + +
Fine arts, music, architecture	+ +		
Business, commerce, journalism	+ +		
Industrial arts, physical education, agriculture			− − −
School Subjects Studied and Done Well			
Algebra			+ + +
Dramatics	+ + +	+ +	+ + +
Economics		+ + +	+ + +
English	+ + +	+ +	+ + +
Foreign languages	+ + +	+ +	+ + +
History	+ + +		+ + +
Mechanical drawing	− −	− − −	− − −
Physical training		−	
Public speaking		+ + +	+ + +
Shop work	− − −	− −	− − −
Trigonometry			+ + +
Sports Participated In and Done Well			
Tennis, handball, ping-pong, badminton			+ +
Marksmanship		−	− −
Horsemanship	−		
Activities Done a Number of Times			
Adjust clock	−	− −	− − −
Sell article to customer	+		

Table 9.4 *(Continued)*

	Writers	Public Relations Men	Lawyers
Arrange club entertainment	+	+ + +	+ + +
Write essay or poem	+ + +		+ + +
Repair radio set		−	−
Make a speech	+ +	+	+ + +
Adjust carburetor	− − −	− − −	− − −
Hobbies and Free Time Activities			
Amusements (dancing, movies)	− − −		
Painting, sketching	+		
Music		+ +	
Collecting (stamps, etc.)			+ +
Dramatics		+	+ + +
Creative writing	+ + +	+ + +	+ + +
Journalism, school paper	+ + +	+ +	+ + +
Woodworking, cabinet-making	−		− − −
Sheet-metal work			− − −
Metal work, machine shop	−	−	− − −
Auto repair, rebuilding	− − −		− − −
Build powered model plane			− −
Participate in model plane contest			− −
Work on glider or plane	+ + +		
Work Experience			
Semi-skilled manual			− − −
Skilled manual			− − −
Simple clerical	+ +	+	+ + +
Higher office work			+ +
Managerial			+
Academic	+ +		+ + +
Reporter, lawyer, advertising	+ + +	+ + +	+ + +
No work experience		−	− − −
Reason for Choosing Cadet Training			
Love of adventure	+ +		
Best way to serve		−	+
Prefer duties to other branches		+ +	
To prove can make good			− − −

They were about average in other ability areas. They had participated in graphic activities but also in mathematics and engineering.

Artists and Designers. This group had a peak on perceptual-spatial tests and was near average in all other ability areas. The men tended to be urban in background and to have supplemented graphic arts activities with verbal and literary ones.

Lawyers. As a group, these men were above average in general intellectual and numerical abilities and successful in most academic areas, but markedly nonmechanical in both test performance and activities. They fell somewhat below average on psychomotor tests. Coming from urban, well-educated homes, they tended to have verbal and social interests.

Writers. The men in this group were well above average in intellectual abilities, especially the verbal component, and very low on mechanical tests. They were low also on mechanical activity items. Somewhat below average scores were obtained on psychomotor tests. The men were high on verbal subjects in school and on verbal free-time activities.

Public Relations. These men showed a rather flat, average ability profile, distinguished only by below average mechanical scores. Urban and from a well-educated home background, they showed verbal and social, rather than mechanical activity patterns.

CHAPTER 10

Academic and Scientific Professions

In this chapter, data are presented for college professors, social scientists, biological scientists, and physical scientists.

DEFINITION OF GROUPS

College Professor. The group of college professors included college faculty members of all ranks and in all academic fields. Thus, the group was very heterogeneous with respect to the field of knowledge represented, though reasonably homogeneous with respect to the type of function discharged and the setting in which it was discharged. The category corresponded to the DOT code 0-11.50. The 74 men in this group reported an average monthly income of $463, with a standard deviation of $111. Average length of time in the occupation was somewhat less than 6 years.

Social Scientist. The social scientist grouping corresponded to DOT code 0-36 and included the rather wide range of specialties falling within this DOT classification. Typical categories within this class were 0-36.11, Economist; 0-36.21, Psychologist; 0-36.55, Actuary; and

0-36.51, Statistician. If a social scientist were teaching at a college, he would have been included in the previous group. Only those in nonacademic positions appear in this group, and the same holds true of the biological and physical scientists.

In all three of our groups of scientists, many of the men had received training only at the bachelor's or possibly the master's level. The number of Ph.D.'s was quite small. In large part, these groups were made up of journeymen in the science fields, rather than masters. For the 65 social scientists, the average reported monthly income was $562, with a standard deviation of $199. These men had been working in their occupation only about 5 to 5 ½ years, on the average.

Biological Scientist. The group designated biological scientists included a rather wide variety of specific occupations involving life sciences, of which a number were specializations relating to agriculture. The occupations were those covered by DOT codes from 0-35.01 to 0-35.36. Representative of the range of occupations within this group are the following: 0-35.01, Agronomist; 0-35.03, Soil Scientist; 0-35.07, Forester; 0-35.12, Fish and Wild-Life Specialist; 0-35.22, Biologist; 0-35.26, Plant Pathologist. Average monthly income for the 48 biological and agricultural scientists was the rather modest amount of $447, with a standard deviation of $114. The men had spent an average of 6 ½ years in their occupation.

Physical Scientist. The group designated physical scientists was also quite a varied one. It included a fairly large number of chemists of various sorts, falling within DOT code 0-07. In addition, there were a number classified as 0-35.63, Geologist; and a few as 0-35.65, Geophysicist; 0-35.68, Meteorologist; and 0-35.73, Physicist. Finally, the group included a few coded as 0-35.76, Mathematician. Any interpretation of score profiles should recognize both that many of the group were trained only at the B. A. or B. S. level and that there were in the group a number of men from the possibly somewhat less demanding earth sciences. For the 116 men in the whole group, average monthly income was $615, with a standard deviation of $253. The men had spent a little over 6 ½ years in the occupation, on the average.

GROUP MEAN SCORE PROFILES

The profiles for these four groups are presented in Table 10.1. The profiles show a good deal of similarity, as represented by the following rank-difference correlations:

College professors vs. social scientists	0.88
College professors vs. biological scientists	0.66
College professors vs. physical scientists	0.71
Social scientists vs. biological scientists	0.83
Social scientists vs. physical scientists	0.66
Biological scientists vs. physical scientists	0.59

All four groups were high on the tests of general intellectual abilities. Numerical ability was generally above average, as was performance on the perceptual and spatial tests.

The physical scientists differed from the other three groups in being higher on measures of mechanical ability, especially the Mechanical Principles test. The college professors were especially high on the Reading Comprehension test. The group in biological science occupations was somewhat less outstanding than the other three groups.

Table 10.1
Mean Standard Score Profile for Physical and Earth Scientists, Biological Scientists, Social Scientists, and College Professors

	Physical and Earth Scientists	Biological Scientists	Social Scientists	College Professors
Reading Comprehension	56	9	41	71
General Information—Navigator	70	42	66	56
Mathematics	70	29	46	50
Arithmetic Reasoning	50	23	44	55
Numerical Operations I	11	5	32	32
Numerical Operations II	22	21	30	31
Dial and Table Reading	22	4	20	32
Speed of Identification	14	3	5	27
Spatial Orientation I	13	31	31	37
Spatial Orientation II	26	23	13	23
Mechanical Principles	30	−2	−37	−2
General Information—Pilot	14	12	9	−17
Two-Hand Coordination	−3	−13	−26	−24
Complex Coordination	6	−3	−20	9
Rotary Pursuit	5	−15	−15	−26
Finger Dexterity	−19	−7	−5	12
Aiming Stress	−14	−31	−30	8
Discrimination Reaction Time	13	11	5	23
Biographical Data—Pilot	−15	0	−49	−48
Biographical Data—Navigator	4	34	32	17
N	113	48	65	72

Further features of the test score patterns are brought out in the five score composites representing different aspects of ability. The pattern is as follows:

	Physical Scientists	Biological Scientists	Social Scientists	College Professors
General intellectual	80	33	64	75
Numerical	22	12	33	38
Perceptual-spatial	23	25	21	38
Mechanical	5	−7	−49	−33
Psychomotor	−8	−21	−26	1

The social scientists and college professors were notably low on the mechanical composite, whereas the physical and the biological scientists were about average in this dimension. Biological and social scientists appeared somewhat below average in psychomotor performance. Biological scientists showed the least differentiated test profile.

BIOGRAPHICAL DATA ITEM RESPONSES

The items on which these groups showed significant differences from the total group of respondents are summarized in Table 10.2.

Social scientists and college professors showed similar personal histories in many respects. Both tended to have come from homes with many books, to have had well-educated mothers, and to a lesser extent to have had well-educated fathers. (One speculates that these may be children of ex-schoolteachers in a number of cases.) Both had tended to go on to college before entry into the Air Force and had done well in a variety of verbal academic subjects, but had either not taken or not done well on mechanical drawing. Social scientists had also done well on mathematics. Both were high on speechmaking, but low on carburetor-adjusting, and both showed other evidences of a deficit in mechanical activities. Both showed some deficiency in the contact sports of football and baseball, though the college professors compensated by a high incidence of tennis and handball. The college professors were also distinguished by participation in various literary and esthetic activities.

In background, the biological and agricultural scientists were very different from the above groups. They, too, tended to have gone on to college before entering the Air Force, but were more likely than most groups to have majored in agriculture. They tended to be rural in back-

Table 10.2
Significant Biographical Data Item Responses for College Professors and Scientists

	Physical and Earth Scientists	Biological Scientists	Social Scientists	College Professors
General Family and Personal Background				
Lived mostly in the city	–	– – –		
Many books in the home			+ + +	+ + +
Many tools in the home			–	
Had some college education	+ + +	+ + +	+ + +	+ + +
Father graduated from high school		+		+ +
Mother graduated from high school			+ + +	+ + +
Parents strongly favored joining Air Force		– –		– – –
Family owned expensive car		– –		
Has driven or ridden motorcycle		–	– – –	
Family or close friend has been a pilot	+ + +			
Major Subject in College				
Did not attend college	– – –	– – –	– – –	– – –
Foreign languages			+	
Social sciences or philosophy	– – –		+ + +	
Education				+ +
Business, commerce, journalism	– –			
Industrial arts, physical education, agriculture		+ + +		
Biological science, medicine	+ + +	+	+ +	+ + +
Physical science, mathematics, engineering	+ + +			
School Subjects Studied and Done Well				
Algebra	+ + +		+ +	+
Dramatics				+ + +
Economics			+ + +	+ + +
English	+ +	+	+ +	+ + +
Foreign languages	+ +	+ +	+ + +	+ + +
History				+ +
Mechanical drawing		– –	– –	– –

Table 10.2 (*Continued*)

	Physical and Earth Scientists	Biological Scientists	Social Scientists	College Professors
Music				+ + +
Physics	+ + +			
Public speaking		– –	+ + +	+ + +
Shop work				– – –
Trigonometry	+ + +		+ + +	
Sports Participated in and Done Well				
Football, rugby, soccer				– –
Baseball, soft ball			– –	– –
Tennis, handball, ping-pong, badminton				+ + +
Marksmanship			–	
Track (dashes, hurdles)			– –	
Track (longer races)		+ +		
Horsemanship				–
Activities Done A Number of Times				
Adjust clock				– –
Write technical report	+ + +			+ + +
Arrange club entertainment				+ + +
Write essay or poem				+ + +
Repair radio set				– –
Make a speech			+ + +	+ + +
Adjust carburetor			– – –	– – –
Hobbies and Free-Time Activities				
Amusements (dancing, movies)				– –
Music				+ + +
Collecting (stamps, etc.)			+ +	+ +
Dramatics			+ +	+ +
Creative writing			+ + +	+ + +
Journalism, school paper			+ + +	+ + +
Boy Scouts		+		+
Photography	+ +			
Amateur motion pictures	– –			+ + +
Woodworking, cabinet-making				– – –
Sheel-metal work			–	– – –
Metal work, machine shop	–		– – –	– – –

Table 10.2 (*Continued*)

	Physical and Earth Scientists	Biological Scientists	Social Scientists	College Professors
Auto repair, rebuilding			– – –	– – –
Build nonflying plane models	+		–	
Build powered model plane	+ +	–	– –	
Participate in model plane contest		–		–
Work Experience				
Unskilled manual	+	+ +		
Skilled manual			– – –	– – –
Minor supervisory	– –		– –	
Engineering, drafting, surveying	+ + +			
Simple clerical	–			
Sales—auto, real estate, etc.				–
Academic			+ + +	+ + +
Scientific	+ + +		+ +	+ + +
Semi-professional	+			
Reporter, lawyer, advertising				+ +
Personal service			+ +	+
Entertainer				+
Reason for Choosing Cadet Training				
Best way to serve				+ + +
Feel have aptitude			–	
Prefer duties to other branches	+			

ground, and to have come from a family that did *not* own an expensive car. They had not been outstanding in schoolwork. Their work experience showed a surplus in the unskilled manual category. In general, they appeared to have come to college, and later to science, from a somewhat limited rural background.

The physical and earth science group exhibited technical and scientific activities in their background, but showed little else of a distinctive nature. Thus, they tended already to have attended college, with a relatively high likelihood of having majored in physical sciences, mathematics, or engineering, and a relatively low likelihood of having majored in social sciences. They had done well in mathematics and physics courses in school, had written technical reports, had worked in some type of engineering or scientific activity. It was almost solely in these respects that they were distinguished from the general population of respondents.

SUMMARY STATEMENT

This chapter presents results for college professors and for three groups of scientists.

College Professors and Social Scientists. The college professors and social scientists were in many respects like the lawyers and writers described in Chapter 9. They were highest in general intellectual ability and markedly low on the mechanical tests. Their background showed a surplus of verbal and a deficiency of mechanical activities.

Biological Scientists. Biological scientists showed less of a peak in general intellectual tests than did the professors or other scientists. Their ability pattern lacked marked peaks or hollows. They appeared to be a somewhat rural group, not markedly distinguished in other ways.

Physical Scientists. Physical scientists were high in general intellectual ability and slightly above the population average on numerical and perceptual tests. Their background was distinguished by quantitative, technical, and scientific activities both in school and in work experience.

CHAPTER 11

School Administrators and Teachers, Clergymen and Welfare Workers

This chapter is devoted primarily to reporting data on men employed in elementary or secondary education. We divided these men up into five occupational groupings. Four of these were reasonably homogeneous in composition—high school principals, high school mathematics and science teachers, high school English, language and social studies teachers, and elementary school teachers. The fifth group was made up of a miscellany of other sorts of high school teachers, as described below.

Two other groups have been included in this chapter, in part because there appeared to be no other more appropriate place to report the data on them and in part because they deal with the broad area of human betterment. These are clergymen and welfare workers.

DEFINITION OF GROUPS

High School Principal. The group designated high school principals corresponds to DOT code 0 31.10. One or two academic administrative officers (0 99.32) were included in the group, but otherwise it was quite homogeneous. The 68 men in this group reported an average monthly income from their work of $479, with a standard deviation of $130. They had worked in the field of education for somewhat less than 7½ years, on the average.

High School Math or Science Teacher. The group of high school math and science teachers represented a subgrouping within DOT code 0-31.01. Because numbers seemed sufficient to justify the step and because it was felt that the characteristics of teachers might differ quite a good deal, depending upon what they taught, we made three subdivisions of the high school teacher group. The first of these was made up of mathematics and science teachers. There were 79 men in this group who reported an average monthly income of $395 from their work. The standard deviation was only $78. Thus the teacher groups show the lowest pay of any of the professional groups that we have examined thus far, and show relatively little spread of income level. Average time in the occupation was slightly over 6 years.

High School English, Language, or Social Studies Teacher. The second subgrouping of high school teachers (also DOT 0-31.01) included English, foreign language, and social studies teachers. There were very few foreign language teachers, and the group was about equally divided between the other two categories. Average monthly income for the 43 men in this group was only $389, with a standard deviation of $68. The men had been in the occupation for slightly over 6 years, on the average.

High School Teacher, Miscellaneous. The remainder of the high school teachers were lumped in a third group. This group included substantial numbers of teachers of shop and industrial arts, business, art, music, and physical education. These are coded as 0-31.01. In addition, the group included men classed as 0–32.30, Vocational Teacher; 0–57.21, Coach; 0–57.41, Instructor of Physical Education; and 0-57.52, Director of Athletics. Thus, the instruction in this group was largely nonacademic and a substantial proportion were concerned with physical skills. Pay for the 152 men in this group averaged $421 per month, with a standard deviation of $106. The group was both somewhat better paid and somewhat more variable in pay than those in the academic subjects. Men in this group had worked in the occupation for an average of slightly more than 6½ years.

Elementary School Teacher. The fifth grouping dealt with in this chapter was made up of elementary school teachers. These correspond to DOT code 0-30.11. There were 64 men in this group. They reported earning an average monthly income of $387, with a standard deviation of $86. Average time in the occupation was approximately 6 years.

Clergyman. In addition to the groups of teachers, we present data in this chapter on a group of clergymen, 0-08.10. There were 33 men

Table 11.1

Mean Standard Score Profiles for School Principals and Teachers

	High School Principals	High School Mathematics, Science Teachers	High School English, Language, Social Studies Teachers	Other High School Teachers	Elementary School Teachers
Reading Comprehension	24	14	−43	−11	−26
General Information—Navigator	20	31	−9	−2	3
Mathematics	11	29	−56	−7	−2
Arithmetic Reasoning	21	35	−48	−5	−3
Numerical Operations I	5	−2	−22	11	31
Numerical Operations II	13	15	−24	8	22
Dial and Table Reading	8	14	−47	7	−9
Speed of Identification	−13	−8	−16	5	−23
Spatial Orientation I	−6	−4	−3	5	−20
Spatial Orientation II	−10	2	−28	3	−18
Mechanical Principles	11	12	−78	−3	−58
General Information—Pilot	−2	−37	−48	16	−32
Two-Hand Coordination	−1	9	−76	6	−54
Complex Coordination	−22	5	−32	−2	−23
Rotary Pursuit	−16	−6	−20	25	−27
Finger Dexterity	−2	1	−10	0	−4
Aiming Stress	−23	−6	14	−12	−32
Discrimination Reaction Time	1	12	−42	0	−32
Biographical Data—Pilot	−29	−24	−77	−2	−61
Biographical Data—Navigator	21	10	−6	17	−8
N	68	77	42	151	63

in this group. Average monthly income was the very modest amount of $349, with a standard deviation of $109. Time spent in the occupation averaged somewhat under 5½ years, indicating that it had taken a number of the men some time to train for or find their way into this occupation.

Social or Welfare Worker. A final group was made up of social and welfare workers. These men were mostly in occupations grouped under the 3-digit DOT code 0–27, Social and Welfare Workers. A number of different specialties were found within this broad category. Over half the men were classed as 0–27.20, Social Case Worker. Other specific occupations represented included 0–27.06, Playground Director; 0–27.11, Welfare Director; 0–27.30, Social Welfare Research Worker; and 0–27.40, Group Worker. Average monthly income for the 19 men in the group was $387 (no standard deviation available) and they had spent an average of somewhat more than 5½ years in the occupation. Thus, this appears also to be a rather poorly paid group and one in which a number of men had been working for only a limited period.

GROUP MEAN SCORE PROFILES

The mean standard scores for each group of teachers on each test are shown in Table 11.1. In certain cases, these profiles have little similarity. This is shown by the rank-difference correlations between profiles exhibited below.

	2	3	4	5
1. Principals	0.82	-0.15	-0.08	0.49
2. High school mathematics and science		-0.25	-0.33	0.50
3. High school English, social studies			0.19	0.31
4. High school, other				0.22
5. Elementary school				

The high school principals closely resembled the mathematics and science teachers. However, the profiles for these two groups were negatively correlated with those for the other high school groups. These, in turn, bore little relationship to each other. The elementary school teachers showed a moderate resemblance to the principals and mathematics and science teachers, but little resemblance to the other two teacher groups. Thus, the decision to break these teacher groups up into separate fractions for analysis received some empirical support from the lack of resemblance among their profiles.

The summary table, based on composites of separate test scores, helps to bring out the general pattern of strengths and weaknesses. This tabulation appears below.

	Principals	High School Mathematics and Science	High School English, Social Studies	High School, Other	Elementary School
General intellectual	25	35	-50	-8	-9
Numerical	10	11	-37	10	18
Perceptual-spatial	-13	-4	-20	6	-27
Mechanical	-8	-1	-102	0	-75
Psychomotor	-24	-2	-18	4	-32

Table 11.2

Mean Standard Score Profiles of Clergymen and Social and Welfare Workers

	Clergymen	Social and Welfare Workers
Reading Comprehension	−11	−8
General Information—Navigator	12	15
Mathematics	17	−7
Arithmetic Reasoning	21	−25
Numerical Operations I	7	8
Numerical Operations II	−10	−18
Dial and Table Reading	5	−76
Speed of Identification	−25	−5
Spatial Orientation I	−17	−18
Spatial Orientation II	3	−20
Mechanical Principles	−6	−54
General Information—Pilot	−49	−16
Two-Hand Coordination	8	−54
Complex Coordination	−7	−56
Rotary Pursuit	11	−42
Finger Dexterity	6	−15
Aiming Stress	−11	22
Discrimination Reaction Time	19	−45
Biographical Data—Pilot	−11	−43
Biographical Data—Navigator	22	21
N	33	19

The high school principals and the mathematics and science teachers were highest on the general intellectual tests. They also tended to be slightly above average on the numerical tests. The rest of their profiles fell close to average and were relatively undifferentiated, except that the principals were somewhat low on the psychomotor tests.

Our group of English and social studies teachers was below average on practically all tests. The scores on even the tests of verbal ability were surprisingly low. Not so surprising is the fact that this group was very low on tests involving a mechanical factor. There was little evidence of strength in this group and little cue as to what would make a good teacher in these fields. The rather unprepossessing picture of the group may be due to peculiarities in the parent population, which was a voluntary one, self-selected in terms of interest in planes and flying. In a parent population that was predominantly mechanically oriented, the small group who ended up teaching verbal materials may have been those who were to some extent misfits in both camps. The poor scores may have resulted from sampling vagaries in a group of only 43. In any event, one hesitates to accept the profile at face value as representing the population of young male high school teachers of English and social studies. On the other hand, it must be recognized that the pay that these men were getting was quite low, and it would be reasonable to expect that some of the abler men might have left teaching for fields in which they could make a more adequate living.

The group that includes the remainder of the high school teachers presented rather a flat profile, with most of the averages falling quite close to the average for the total group of Aviation Cadet applicants. It must be remembered that this was quite a heterogeneous group. Distinctive features that would have appeared for teachers of specific subjects may have been lost in the pooling.

The elementary school teachers were above average only on the tests of simple numerical ability. They were notably low on mechanical ability and rather low on most measures of perceptual and of motor ability.

The mean standard score profiles of the clergymen and social and welfare workers are shown in Table 11.2. These two profiles have no resemblance, the rank-difference correlation between them being −0.01. We can see the general trends of the two more clearly if we consolidate the separate test scores into five composites of related tests. These are shown below:

	Clergy	Social Workers
General intellectual	13	−8
Numerical	1	−35
Perceptual-spatial	−17	−40
Mechanical	−4	−67
Psychomotor	0	−34

The clergymen showed a rather flat profile falling close to the average of the Aviation Cadet population. They showed a slight elevation on the general intellectual measures and a slight depression on the perceptual-spatial tests, but these were very minor. The social workers were close to average on the general intellectual composite, but below on all the others and especially low on the mechanical measures. They appeared to be a moderately verbal, but clearly a nonmechanical group.

BIOGRAPHICAL DATA ITEM RESPONSES

Table 11.3 summarizes the data on biographical items on which the groups considered in this chapter differ significantly from the total group of respondents. The number of significant items for the small group

Table 11.3
Significant Biographical Data Item Responses for Teachers and Clergymen

	High School Principals	High School Science, Mathematics Teachers	High School English, Social Studies Teachers	High School Teachers Other	Elementary School Teachers	Clergymen
General Family and Personal Background						
Lived mostly in the city	– – –	– – –		– – –		–
Many books in the home						+ +
Many tools in the home			– – –			
Had some college education	+ + +	+ + +	+ + +	+ + +		+ + +
Father graduated from high school			– –			
Duration of interest in aviation career				– –		
Family owned expensive car	–	– – –			– – –	
Is a good safe driver					–	
Has driven or ridden motorcycle	–				– –	
Major Subject in College						
Did not attend college	– – –	– –	– – –	– – –	–	– –
Foreign languages						+ +
Social sciences or philosophy	+ + +		+ + +			+ + +
Education	+ + +	+ + +	+ + +	+ + +	+ + +	
Fine arts, music, architecture				+ + +		
Business, commerce, journalism		– – –	–	– – –		
Industrial arts, physical education, agriculture	+	+ + +		+ + +		
Biological science, medicine	+ +	+ + +			+	
Physical science, mathematics, engineering	– – –	+	–			
English, literature, drama		– –	+ +	– – –		
School Subjects Studied and Done Well						
Dramatics	+	+	+ +	+ + +		+ + +
English						+ +
Foreign languages			+ +	–	+	
History	+ + +		+ + +		+	
Mechanical drawing			– –			
Music			+			+ + +
Physical training		+			+	
Physics	– –	+ +	– – –			
Public speaking	+ + +		+ +	+ + +	+	+ + +
Shop work			– –			
Trigonometry		+ +	– – –			

Table 11.3 *(Continued)*

	High School Principals	High School Science, Mathematics Teachers	High School English, Social Studies Teachers	High School Teachers Other	Elementary School Teachers	Clergymen
Sports Participated in and Done Well						
Football, rugby, soccer				+ + +		
Basketball, hockey, lacrosse	+ +			+ + +		
Baseball, softball				+ +		
Boxing, wrestling, water polo					–	
Crew, rowing, canoeing					–	
Diving, ski jumping						+ +
Marksmanship			–		– – –	
Sailboating					– –	
Auto, motorcycle, motorboat						
racing	– –	–			–	
Swimming	–					
Track (dashes, hurdles)				+ +		
Track (longer races)	+ +	+ +		+ +		
Track (field events)				+ + +		
Horsemanship			–		– –	
Activities Done A Number of Times						
Arrange club entertainment	+ +		+ +		+ + +	+ +
Write essay or poem			+ + +		+ +	+ + +
Interview men for job		–		–		
Arrange flower garden	+	+ + +			+ + +	
Make a speech	+ + +		+	+ +	+	+ +
Adjust carburetor		–	– – –		– – –	– – –
Hobbies and Free-Time Activities						
Amusements (dancing,						– – –
movies)			+ +			
Painting, sketching						+ + +
Music					+ +	
Collecting (stamps, etc.)				+ + +		+ + +
Dramatics	+ + +		+ + +		+	+ + +
Creative writing			+ + +		+ + +	
Journalism, school paper	+ +					+ +
Boy Scouts					–	
Photography						
Woodworking, cabinet-			– –	+ + +		+ +
making				+ + +		
Sheet-metal work				+ +		– –
Metal work, machine shop			– – –		– – –	–
Auto repair, rebuilding						
Build nonflying plane models		– –				

Table 11.3 *(Continued)*

	High School Principals	High School Science, Mathematics Teachers	High School English, Social Studies Teachers	High School Teachers Other	Elementary School Teachers	Clergymen
Build powered model plane	–	– –	– – –	– – –		
Participate in model plane contest					– –	
Work on glider or plane	– –			+		–
Work Experience						
Unskilled manual	+ + +	+ + +		+ + +		+ +
Semi-skilled manual				+		
Skilled manual	– –					
Engineering, drafting, surveying					– –	
Simple clerical		– – –		–		+ +
Sales clerk, canvasser	+ +					
Managerial				–		
Academic	+ + +	+ +		+ + +		+ +
Instructor or leader	+ + +		+ +	+ +		+ + +
Personal service	+	+				
Entertainer				+ + +		+ + +
Social service						+ + +
No work experience				+		
Reason for Choosing Cadet Training						
Feel have aptitude					– –	
Better pay than other branches		+ + +				
To get away from home	+					

of social welfare workers was too small to justify interpreting and reporting them.

Although there was some correspondence in the backgrounds and experiences of the groups considered in this chapter and though the trends were more often consistent than they are contradictory, the differences were sufficiently numerous to require that we consider each of the groups in turn.

The high school principals tended to come from small town or rural backgrounds. They had frequently had some college before entering the Air Force, where they were more likely than the total group to have majored in education, social sciences, or biological sciences. They tended not to have majored in physical sciences and mathematics. In school they had frequently done well in history and in public speaking but not in physics. Associated with the academic success in public speaking was free-time experience in speech-making and dramatics. They had seldom worked at skilled manual work, but relatively frequently at unskilled manual work, retail or door-to-door selling, and instructing or working with groups. In general, they appeared to be verbally fluent and socially competent, but not technically or mechanically oriented.

The mathematics and science teachers also tended to come from small town or rural backgrounds and from modest financial circumstances, as evidenced by infrequent ownership of an expensive car. They had frequently had college experience before entering the Air Force, majoring often in education, industrial arts, or agriculture, or biological sciences, but relatively rarely in business, commerce, or journalism. They had some tendency to show superior performance in such scientific and technical subjects as physics and trigonometry. They had often arranged a flower garden and had worked at unskilled manual work. They had relatively rarely engaged in clerical work. One pictures a rural or small-town boy from a fairly modest home with somewhat above average ability in quantitative material.

The English and social studies teachers came from homes that were characterized by a lack of tools and by a relatively low level of paternal education. They had tended to go to college prior to entering the Air Force, often majoring in education, social studies, or English. They had participated successfully in school courses in dramatics, foreign languages, history, and public speaking, but were low on quantitative or practical courses, such as physics, trigonometry, mechanical drawing, or shop work. They had engaged in free-time writing and artistic activities, but showed a deficit in several activities of a mechanical nature. They had participated relatively infrequently in marksmanship or horsemanship. They appeared, not too surprisingly, to be a verbal, nonmechanical group, somewhat like but perhaps less clear-cut than the social scientists or college professors.

The remaining miscellaneous group of high school teachers was, like the principals and science teachers, a small-town or rural group from homes of modest circumstances (i.e., rarely owning an expensive car). These men also tended to show some college experience in their premilitary careers, being likely to have majored in education, physical education, or industrial arts. Majors in business were relatively infrequent. They showed a high percentage of successful participation in dramatics and public speaking in school. Following rather directly from the substantial number of physical education teachers and coaches in the group, we find that they reported high frequency of successful participation in football, basketball, and track field events. The group showed frequent free-time participation in woodworking and metalworking, and this should probably be related to the presence of industrial arts teachers in the group. Work experience tended to have been either in unskilled or semi-skilled manual labor, or in academic work. In general, we have again a small-town or rural group of modest means, who had engaged in training for or activities closely related to the types of skills they were now teaching to others.

The distinctive characteristics of the elementary school group were mostly negative. They came from modest circumstances (few expensive cars), had engaged infrequently in a number of types of sports, and were low on several items of a mechanical nature. They were high only in performance in history, arranging a club entertainment, writing an essay or poem, and arranging a flower garden. Thus, we see them as a rather nonathletic, nonmechanical group from modest homes.

The clergymen tended slightly to come from nonurban backgrounds, and from homes with many books. Many of them had started college prior to entry into the Air Force, and they showed a high rate of majoring in foreign languages and social sciences and philosophy. Responses to a number of items suggest verbal, musical, and dramatic talents and/or interests. In school they were high on dramatics, English, and music. They had frequently arranged a club entertainment, written an essay or poem, and made a speech. They frequently reported as free-time activities music, dramatics, creative writing, and participation in Boy Scouts. There was some indication of a deficit in mechanical activities—adjusting a carburetor, metalworking, and auto rebuilding and repair. Work experience was varied—unskilled labor, simple clerical, retail sales, academic, instructor and group leader, entertainer, and social service—but they were not high on mechanical and skilled types of jobs.

SUMMARY STATEMENT

This chapter reports data on school teachers and principals. Five groups were studied and are briefly characterized below. In addition, material is presented on clergymen and social service workers.

High School Principals. These men showed a rather flat ability profile close to the average for the total group of cadet applicants. They were slightly above average on general intellectual measures and slightly below average on psychomotor tests. They tended to be a nonurban group from modest home backgrounds, fairly verbally fluent, and socially competent but not technically or mechanically oriented.

Science and Mathematics Teachers. This group was somewhat above average in general intellectual measures and close to average on tests of other types. Also of rural background, their distinctive background experiences were primarily those related to scientific and quantitative matters.

English and Social Science Teachers. This group did poorly on all types of tests and was outstandingly poor in the mechanical area. They were characterized by success and participation in verbal experiences, but not in mechanical. They came from homes characterized both by lack of tools and low paternal education. Both test scores and home background appeared a little surprising and suggested that this might be a nonrepresentative group for the occupation.

Other High School Teachers. The ability profile of these men was very flat, and close to the average for all cadet applicants. They appeared to be a small town or rural group of modest means with activity backgrounds rather directly related to the physical or mechanical skills they were currently teaching.

Elementary School Teachers. This group showed abilities ranging from near average for numerical and intellectual tests to quite low for mechanical measures. Their experience pattern was characterized primarily by lack of experience in certain sports and mechanical activities.

Clergymen. The ability profile was flat and close to the general Aviation Cadet average, showing only a slight peak on the general intellectual tests and hollow on the perceptual-spatial measures. The group tended to have gone to college, where their interests and achievements seemed to have centered in such fields as philosophy, languages, music, and dramatics. They were a words-and-persons-oriented rather than a thing-oriented group.

Social Service Workers. In ability tests, this group fell near the Aviation Cadet average on general intellectual measures, but was below on the other tests and specially low on the measures of mechanical ability. Significant Biographical Data items were too few to justify reporting.

CHAPTER 12

Medical and Related Occupations

In this chapter data are presented for physicians, dentists, and other groups whose activities are based in some degree upon the life sciences. The numbers in these groups are small, and certain of the groups are quite varied in their composition, so that the results presented here must be considered quite tentative.

DEFINITION OF GROUPS

Dentist. The first group was composed of 44 dentists. Any of the dental specialties subsumed under DOT code 0-13.10 was included in this group. Those men who gave information on their income reported an average monthly income of $1020, giving them the highest income of any of the groups included in the study. The standard deviation was $314. They reported an average time in the occupation of slightly over 5 years.

Physician. The second group was made up of 46 physicians. With the exception of one or two internes, who are coded 0-26.30, these men fell under DOT code 0-26.10. For those men who reported it, the average monthly income was $830, with a standard deviation of $527. The men had been working in the occupation for only about 4½ years, on the average.

Veterinarian. A profile was prepared for 9 veterinarians (0-34.10), more as a matter of curiosity than for the value of data from this small group. The men in this group reported an average income of $496 (standard deviation not available). They were quite new in the occupation, having spent only a little over 3½ years in it, on the average.

Pharmacist. One medically-related group consisted of 46 pharmacists. These correspond to DOT code 0-25.10. For this group, the average monthly income was $507, with a standard deviation of $127. Time in the occupation averaged 7 years.

Optometrist. A second medically related group was composed of 34 optometrists (DOT code 0-39.92). These men reported an average monthly income of $739, with a standard deviation of $383. Time in the occupation averaged almost 7½ years.

Medical, Miscellaneous. The third medically-related group was quite heterogeneous. It included a number classified as 0-39.90, Chiropractor; 0-52.01, Chiropodist; and 0-52.22, Physical Therapist and a scattering of men in similar jobs. The 30 men in this group reported an average income of only $460 (standard deviation not available). Average time in the job was not quite 6 years.

Undertaker. The last group considered in this chapter was one made up of 14 undertakers (0-65.20). These men reported an average income of $472 per month (standard deviation not available). The men had worked in the occupation for an average of almost 8½ years.

GROUP MEAN SCORE PROFILES

Table 12.1 presents profiles for dentists, physicians, and veterinarians. The profiles for dentists and physicians have a fair degree of similarity (rank-difference correlation 0.59). The main features of the test profiles are summarized in five score composites as shown below.

	Physicians	Dentists	Veterinarians
General intellectual	76	36	-10
Numerical	24	24	-2
Perceptual-spatial	23	20	-26
Mechanical	-4	-27	1
Psychomotor	-8	1	-9

Both physicians and dentists had their highest scores on the general intellectual composite, and within this composite it was the mathe-

Table 12.1
Mean Standard Score Profiles of Dentists, Physicians, and Veterinarians

	Dentists	Physicians	Veterinarians
Reading Comprehension	9	35	−5
General Information—Navigator	24	75	0
Mathematics	43	87	−10
Arithmetic Reasoning	36	39	−17
Numerical Operations I	23	7	33
Numerical Operations II	19	9	−21
Dial and Table Reading	18	45	−17
Speed of Identification	20	6	−22
Spatial Orientation I	21	20	−26
Spatial Orientation II	5	27	−11
Mechanical Principles	−11	28	−5
General Information—Pilot	−13	39	−51
Two-Hand Coordination	−33	−21	8
Complex Coordination	−14	−11	4
Rotary Pursuit	−8	1	9
Finger Dexterity	24	9	−27
Aiming Stress	0	−21	−9
Discrimination Reaction Time	15	7	−15
Biographical Data—Pilot	−17	−15	−1
Biographical Data—Navigator	30	35	11
N	44	46	9

matics test on which they did best. Possibly this is due to the educational requirements for entry into both of these professions. The intellectual peak for physicians was markedly higher than for the dentists. Both groups were somewhat above average on numerical and perceptual-spatial tests, and below average on the mechanical composite. The dentists showed a more marked mechanical deficiency. There was a suggestive minor peak in the dentists' profile for the Finger Dexterity Test.

The profile for veterinarians is presented more as a matter of curiosity than for any real value, since it was based on only nine cases. As a group, the veterinarians were clearly much less able on these tests than were the dentists and physicians. The veterinarians' profile was a rather flat one, the only distinctive feature being a low spot for the perceptual-spatial tests.

Profiles for four medically-related groups are shown in Table 12.2. Three of these, the pharmacists, optometrists, and undertakers, show quite similar profiles and profiles which resemble that of dentists, as evidenced by the following rank-difference correlations:

Pharmacists vs. optometrists	0.71
Pharmacists vs. dentists	0.65
Optometrists vs. dentists	0.61
Pharmacists vs. undertakers	0.73
Optometrists vs. undertakers	0.61
Dentists vs. undertakers	0.42

The miscellaneous group that we have designated *Medically Related* gives a profile with little resemblance to the others.

Profiles for the five test composites are as follows:

	Pharmacists	Optometrists	Medically Related	Undertakers
General intellectual	38	19	−11	−19
Numerical	47	41	−24	28
Perceptual-spatial	−12	−4	−24	−46
Mechanical	−16	−22	−9	−37
Psychomotor	15	10	0	−23

Pharmacists, optometrists, and undertakers were all highest on the numerical composite. Relating this to results to be reported in later

Table 12.2
Mean Standard Score Profiles of Certain Groups Related to Medicine

	Pharmacists	Optometrists	Medically Related	Undertaker
Reading Comprehension	1	−9	−3	−22
General Information—Navigator	36	19	−14	−1
Mathematics	26	28	−8	−9
Arithmetic Reasoning	54	20	−9	−26
Numerical Operations I	36	31	−20	54
Numerical Operations II	36	37	−31	5
Dial and Table Reading	44	35	−8	11
Speed of Identification	−18	0	−19	−30
Spatial Orientation I	21	−2	−9	−37
Spatial Orientation II	−31	−8	−28	−39
Mechanical Principles	−9	−15	−9	−48
General Information—Pilot	−29	−18	−32	−32
Two-Hand Coordination	16	−9	−6	−9
Complex Coordination	−1	21	−17	−28
Rotary Pursuit	9	10	−14	−17
Finger Dexterity	36	15	42	10
Aiming Stress	−4	−20	−11	−26
Discrimination Reaction Time	−3	−38	−6	−26
Biographical Data—Pilot	−44	−27	−6	−26
Biographical Data—Navigator	15	41	25	−6
N	46	34	30	14

chapters leads us to suspect that we should think of these groups primarily as business men. All three of these groups were quite low on the mechanical composite. Pharmacists, and to a lesser extent optometrists, showed up fairly well on the general intellectual tests, and both groups were above average on psychomotor measures. The small group of undertakers was quite low on the tests of the perceptual-spatial group.

The medically related group showed a relatively flat, slightly below average profile. The only cluster in which this group came up to average was the psychomotor one.

BIOGRAPHICAL DATA BLANK ITEM RESPONSES

Item responses on the Biographical Data Blank deviating significantly from the percentages for the total respondent group are summarized in Table 12.3. This table includes only 5 of the 7 groups for which test score profiles were presented. The other two groups, veterinarians and the mixed medically related group, yielded so few differences significant at the 0.05 and 0.01 level that those that did occur could have done so by chance alone. For this reason, no tabulation of these responses seemed meaningful.

Table 12.3
Significant Biographical Data Items for Medical and Medically Related Groups

	Physician	Dentist	Pharmacist	Optometrist	Undertaker
General Family and Personal Background					
Many books in the home	+ + +		–	+ +	
Had some college education	+ + +	+ + +	+ + +	+ + +	
Father graduated from high school	+ + +	+			
Mother graduated from high school	+ + +				
Parents strongly favored joining Air Force			– –	–	
Duration of interest in aviation career			– –		
Family owned expensive car					+
Major Subject in College					
Did not attend college	– – –	– – –	– –	– – –	
Business, commerce, journalism	– –				

Table 12.3 *(Continued)*

	Physician	Dentist	Pharmacist	Optometrist	Undertaker
Biological science, medicine	+ + +	+ + +	+ + +	+ + +	
Physical science, mathematics, engineering	+ + +				
School Subjects Studied and Done Well					
Algebra	+ + +				
Dramatics					+ +
Economics	+				
English	+ + +		+ + +		
Foreign languages	+ + +	+ +	+ +		
History	+ +				−
Mechanical drawing	−		− −		− − −
Music				+ +	
Physics	+ + +		+	+ + +	
Public speaking	+				
Shop work	−		− −		− −
Trigonometry	+ + +	+ +			
Sports Participated in and Done Well					
Marksmanship		− −			
Sailboating			−		
Auto, motorcycle, motorboat racing			−		
Swimming	+		− −		
Track (dashes, hurdles)	+				−
Track (longer races)					−
Horsemanship			− −		
Activities Done a Number of Times					
Adjust clock					+
Sell article to customer			+ + +		
Write technical report				+ + +	
Arrange club entertainment				+ + +	+ + +
Write essay or poem					−
Interview men for job				+	
Repair radio set		−			
Solicit for a charity				+ + +	
Make a speech	+ +				
Adjust carburetor	− − −		− −	−	−

Table 12.3 *(Continued)*

	Physician	Dentist	Pharmacist	Optometrist	Undertaker
Hobbies and Free-Time Activities					
Painting, sketching			– –		
Music	+			+ +	
Collecting (stamps, etc.)	+ + +	+ +			
Boy Scouts	+ +		–		
Sheet-metal work			–		
Metal work, machine shop			– –	– –	
Auto repair, rebuilding	–	–			
Participate in model plane contest				+ + +	
Work Experience					
Semi-skilled manual				– –	
Skilled manual		– –			
Engineering, drafting, surveying			–		
Sales clerk, canvasser	+ +		+ + +	+	
Managerial					+
Academic	+		+		
Scientific	+		+ + +		
Semi-professional			+ + +	+ + +	+ + +
Reporter, lawyer, advertising		–			
Personal service				+	
Entertainer	– – –				
No work experience	– – –				
Reason for Choosing Cadet Training					
Love of adventure			–		+ + +
Best way to serve	+ + +				+
To use training after war	–				
To prove can make good	– –		+	– –	

Distinctive results on the biographical items were most frequent for the physicians. These men came from well-educated families with many books in the home. The men in many cases had some college training before entering the Air Force. In college they were likely to have majored in biological or physical science. In school, they performed successfully in many subjects of an academic nature, such as algebra, physics, English, and foreign languages. They tended to show up slightly negatively on mechanical drawing and shop work, probably primarily on a basis of not having taken these subjects. Outside the academic context, significant items were relatively few. However, there was a positive difference in participation in collecting, Boy Scouts, and making a speech, and a negative one for adjusting a carburetor and repairing or rebuilding an auto. Work experience showed some plus deviation for retail sales, academic and scientific activities, and a minus deviation for activity as entertainer or for no paid work at all. The group chose serving the nation as a reason for entering flying training more often than the total respondent sample, and was less likely to say that they expected to use the flight training, or that they wanted to prove they could make good. In general, we saw an academically able group from educated families, with a little suggestion of intellectual rather than mechanical interests, possibly somewhat self-confident and altruistic in nature.

Dentists had also tended to start higher education before entry into the Air Force, and also tended to major in the biological sciences. There was less indication of academic success in this group, though they showed some superiority of performance in foreign languages and trigonometry. Few other significant items appeared, though we may note a plus for collecting as a hobby and a minus for skilled manual work.

Pharmacists also tended to have started college before entering the Air Force, and to have majored in the general area represented by biological science and medicine. As a group, they had parents with less than average enthusiasm for aviation as a career for their son and tended not to have given long consideration to aviation as their own career. Their school participation and success tended to be high in English and foreign languages and low in mechanical drawing and shop work. There was some tendency to be low on outdoor sports such as sailboating, car or boat racing, swimming, and horsemanship. A high percentage of them reported experience in selling and in working in sales, academic, scientific, and semi-professional (including pharmacist) jobs. They were somewhat low in participation in handicraft types of hobbies.

Optometrists showed much the same pattern as the previous groups with respect to college education. Like physicians, they came from homes with books. They also showed indications of musical interest and ability. There were a number of activities in which they reported relatively frequent participation, but these do not appear to make any consistent pattern. They included writing a technical report, arranging a club entertainment, soliciting contributions for charity, and participating in model plane contests. Work experience tended to run low on semi-skilled and high on semi-professional.

The pattern for the small group of undertakers showed relatively few significant differences, and perhaps does not justify reporting. The school participation and success pattern showed a little plus on algebra and a minus on mechanical drawing and shop work. The group was high on arranging a club entertainment. Work experience was high in the semi-professional grouping. They frequently reported liking for an adventurous life as the reason for entering the Air Force.

SUMMARY STATEMENT

This chapter discusses seven groups concerned in some way with health or the life sciences. Each is reviewed in a sentence or two below.

Physicians. These men did outstandingly well on the general intellectual tests, and were somewhat above average on numerical and perceptual measures. Coming from well-educated parents, they reported high success on most academic school subjects. Outside the academic sphere, they showed few striking differences in biographical items, though they were possibly somewhat intellectual and nonmechanical in their pattern.

Dentists. As a group dentists were somewhat above average on general intellectual, numerical, and perceptual tests, and quite low on the mechanical composite. Aside from the fact that they had frequently started college before entering the Air Force, tending to major in biological sciences, there was little that was distinctive in their biographical item responses.

Veterinarians. These men, only nine in number, showed a rather flat and slightly below-average profile of test scores.

Pharmacists. The group of pharmacists was highest in numerical ability and next on the general intellectual measures. In the other ability areas, they tended to fall somewhat below average. In their activities, they appeared somewhat oriented toward both business and science, and away from the out-of-doors and the mechanical.

Optometrists. Like pharmacists, optometrists showed a peak on the numerical tests and above-average performance on the general intellectual measures. Their low point was on the mechanical composite. No clear structure emerged from their biographical item responses, other than a tendency to seek higher education in the general biological science fields.

Medically Related. This varied group, including such specific occupations as chiropractor and chiropodist, showed a rather flat somewhat below-average test profile. Few significant biographical item results appeared for this group.

Undertakers. The undertakers were above average on numerical tests, but well below average on all the other test composites. The group was too small to yield very meaningful results for the biographical items.

CHAPTER 13

Engineers and Supporting Groups

The present chapter deals with the profession of engineering and with related or supporting occupations. Because engineers were quite numerous among our respondents, it seemed reasonable to present data separately for specialties within the field of engineering. Six groups were separated out, as defined below. Material is also presented for the four related or supporting occupations of draftsman, specifications writer, laboratory technician and tester, and surveyor.

DEFINITION OF GROUPS

The engineering groupings followed quite closely the main three-digit codes of the DOT. There was, however, one main exception. Experience in the preliminary pilot study had suggested that one finds engineers in all specialties who have a major responsibility for sales contacts and selling. In our initial coding, therefore, an extra digit was added to the basic DOT code for engineers to indicate this sales function. In the final grouping, all those coded in this way were combined into a group of sales engineers.

Sales Engineer. These were persons whose basic specialization might have been in any of the other engineering groups, but whose major job function appeared to be customer contact and sales. There were 127 of these men. The group had an average reported monthly income of $660, the highest of any of the engineering groups. Income was also most variable, with a standard deviation of $323. Average time in the occupation was somewhat under 6½ years.

Chemical Engineer. This category included the DOT categories of 0–14, Metallurgist and Metallurgical Engineer, 0–15, Chemical Engineer; and 0–20.11, Petroleum Engineer. These were considered to be engineering specialties related to the science of chemistry, although it is possible that the activities of the petroleum engineer are such as to make it more appropriate to group him with mechanical engineers. The 84 men in this group reported an average monthly income of $649, for which the standard deviation was $164. The men had been working in the occupation for an average of slightly over 7 years.

Civil Engineer. This group corresponded exactly to DOT code 0–16, and included the various specialties, such as construction engineer, highway engineer, and sanitary engineer, which are grouped under this code category. The group was composed of 129 men. Average monthly income was $571, with a standard deviation of $235, and average time in the occupation was somewhat over 7 years.

Electrical Engineer. The group included the range of specialties under DOT code 0–17. This encompassed specialties related to electrical power plants, telephone systems, and also radio and electronics. There were 130 men in this group. They reported an average income of $564*, and had spent an average of 7 years in the occupation.

Industrial Engineer. This group included those falling under DOT code 0–18, with titles of industrial engineer, efficiency engineer, methods engineer, safety engineer, and time-study engineer. Also included in this category were a few cases from what appeared to be related and supporting occupations with other codes, such as 0–39.94, Traffic Engineer; 0–69.97, Clerical Technician; and 0–69.98, Systems Engineer. For this group of 148 men the average monthly income reported was $556, with a standard deviation of $146. These men had spent an average of somewhat over 5½ years in the occupation.

Mechanical and Aeronautical Engineer. This group was made up primarily of the various specialties coded under 0–19, especially 0–19.01, Mechanical Engineer; and 0–19.03, Aeronautical Engineer. However, the group also included a few men classified as 0–20.01, Mining Engineer. This group was a large one in our population, numbering 309 in all. Average monthly income was $611, with a standard deviation of $135. The men had spent a little less than 7 years on the job, on the average.

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* Data on the standard deviation missing.

Draftsman. The largest supporting group to the engineers was a group of draftsmen. An individual falling in any one of the specialties under DOT 0-48 was included in this group. Many specific varieties of draftsmen appeared, among the most numerous being 0-48.05, Architectural Draftsman; 0-48.11, Electrical Draftsman; 0-48.18, Mechanical Draftsman; and 0-48.41, Tool Designer. There were 160 of these men in all. The average of their reports of monthly income was $477, and the corresponding standard deviation was $92. Average time working as a draftsman was somewhat over 7 years.

Specifications Writer or Estimator. This grouping included those occupations with DOT codes lying between 0-68.50 and 0-68.68. The specific jobs had such titles as production planner, engineering specifications writer, estimator, and engineering scheduler. The group was composed of 102 men, who reported an average monthly income of $503. The standard deviation was $121. The men had spent an average of 6 years in the occupation.

Laboratory Technician or Tester. This group included men from the wide variety of specific jobs of assisting in laboratories and carrying out routine chemical and mechanical tests that are grouped under DOT 0-50. In addition, a few jobs that seemed to involve the use of laboratory apparatus and test equipment in about the same way were included from other major DOT codes. Representative of these were 0-66.66, Seismic Prospecting Observer; 0-66.67, Seismograph Computer; 4-41.91, Pulp Tester; and 4-52.76, Pilot—Control Operator. This was a fairly small group, including only 44 men. Average of reported monthly income was $429, with a standard deviation of $115. The men had worked in their occupation for somewhat under 6½ years, on the average.

Surveyor. We had a little group of 10 surveyors (0-64), whose test score profiles are shown as a matter of interest, but not as having much significance.

GROUP MEAN SCORE PROFILES

Mean standard score profiles for the six groups of engineers are shown in Table 13.1.

Rank-difference correlations were computed among these profiles,

Table 13.1
Mean Standard Score Profile for Engineers: Chemical, Civil, Electrical, Industrial, Mechanical, Aeronautical, and Sales

	Chemical Engineers	Civil Engineers	Electrical Engineers	Industrial Engineers	Mechanical, Aeronautical Engineers	Sales Engineers
Reading Comprehension	48	45	52	23	62	24
General Information—Navigator	77	60	49	31	70	47
Mathematics	119	75	60	56	96	69
Arithmetic Reasoning	84	52	39	25	60	35
Numerical Operations I	33	18	−9	29	15	15
Numerical Operations II	34	21	10	34	25	26
Dial and Table Reading	37	39	14	40	45	41
Speed of Identification	17	44	0	24	28	33
Spatial Orientation I	24	35	1	33	28	29
Spatial Orientation II	29	50	20	21	45	19
Mechanical Principles	31	44	38	−4	51	22
General Information—Pilot	19	23	12	21	56	30
Two-Hand Coordination	2	18	20	−6	27	28
Complex Coordination	21	20	14	10	28	44
Rotary Pursuit	2	9	0	−1	20	20
Finger Dexterity	31	13	9	16	15	35
Aiming Stress	−2	−5	7	−13	−3	8
Discrimination Reaction Time	37	32	18	25	32	32
Biographical Data—Pilot	9	19	14	0	39	39
Biographical Data—Navigator	22	−8	−14	14	2	23
N	83	127	125	148	300	126

and these are shown below. The order of the groups has been rearranged to bring out the most marked relationships.

	Electrical	Mechanical	Chemical	Industrial	Sales
Civil	0.74	0.89	0.70	0.58	0.44
Electrical		0.84	0.58	0.17	0.42
Mechanical			0.61	0.41	0.52
Chemical				0.76	0.41
Industrial					0.43
Sales					

Although there was some similarity of pattern in the profiles of all the engineering groups, there appeared to be subgroupings within the total structure. Civil, electrical, and mechanical engineer patterns were much alike. So were those for chemical and industrial engineers. Sales engineers had a pattern least like those of the other groups.

In general, the profiles for all the groups of engineers tended to be above the average for the total Aviation Cadet applicant group. This tended to be true for all the tests (excepting possibly Aiming Stress) and for all the engineer subgroups. In every group, the highest score was that on the test of mathematics—presumably reflecting the importance of mathematical achievement both for getting into and for completing engineering training. Other tests on which the different engineering groups consistently received high scores were Arithmetic Reasoning, General Information—Navigator, and Reading Comprehension. It is interesting to note that it was on these verbal and quantitative tests, rather than on tests of mechanical abilities, that the engineers were especially outstanding.

Table 13.2
Mean Standard Score Profiles of Certain Occupational Groups Related to Engineering

	Draftsman	Specifications Writer and Estimator	Laboratory Technician and Tester	Surveyor
Reading Comprehension	−5	3	−2	−67
General Information—Navigator	14	17	3	38
Mathematics	4	19	−11	−10
Arithmetic Reasoning	−10	−1	1	−39
Numerical Operations I	−14	1	−9	−22
Numerical Operations II	−9	2	−11	−38
Dial and Table Reading	−12	3	−1	−19
Speed of Identification	29	18	9	17
Spatial Orientation I	21	13	−6	−20
Spatial Orientation II	21	4	7	95
Mechanical Principles	6	3	18	38
General Information—Pilot	23	8	−7	−29
Two-Hand Coordination	15	0	−17	19
Complex Coordination	21	7	21	13
Rotary Pursuit	6	−4	−6	−2
Finger Dexterity	24	1	0	22
Aiming Stress	−11	−11	−3	−13
Discrimination Reaction Time	−1	14	13	−8
Biographical Data—Pilot	10	10	4	28
Biographical Data—Navigator	−45	−9	−24	−81
N	155	100	40	9

To bring out the main features of the test profiles, separate tests were combined into five score composites, as in the preceding chapters, the composites being expressed as standard scores. The pattern of results is as follows:

	Chemical Engineer	Civil Engineer	Electrical Engineer	Industrial Engineer	Mechanical Engineer	Sales Engineer
General intellectual	106	75	65	44	93	57
Numerical	42	31	6	41	34	33
Perceptual-spatial	30	56	9	34	44	35
Mechanical	19	36	32	−4	52	39
Psychomotor	20	14	11	4	23	40

The highest point in each one of the profiles was the general intellectual composite. Civil, electrical, and mechanical engineers showed higher performance on the mechanical tests, relative to their total profile, than did the other groups. Civil and mechanical engineers were also relatively high on perceptual and spatial tests. Chemical and industrial engineers showed greater relative strength on the number tests. Sales engineers showed a very flat profile with performance well above average on all the composites. They were the strongest of any of the engineering groups on the psychomotor tests.

Results for the engineering supporting groups are shown in Table 13.2. These were correlated with each other and with a pooled average of the six engineer groups. The rank-difference correlations are shown below.

	Draftsman	Specifications Writer	Laboratory Technician, Tester	Surveyor
Engineer	0.05	0.58	0.28	0.03
Draftsman		0.51	0.37	0.59
Specifications Writer, Estimator			0.39	0.33
Laboratory Technician, Tester				0.57

The only one of the supporting groups that shows any appreciable resemblance to engineers is the group of specifications writers and estimators. Among the supporting groups, the two that showed the most similarity were draftsmen and surveyors. (It must be remembered that the group of surveyors was very small, and the profile correspondingly unreliable.) Draftsmen and specification writers showed some similarity, as did laboratory technicians and surveyors.

The condensed profiles based on five test score composites are as follows:

	Draftsman	Specifications Writer, Estimator	Laboratory Technician, Tester	Surveyor
General intellectual	1	12	-3	-25
Numerical	-14	2	-8	-32
Perceptual-spatial	31	15	4	40
Mechanical	14	6	2	38
Psychomotor	15	-3	5	8

Specifications writers and estimators, as well as laboratory technicians and testers, showed a generally flat and undifferentiated profile. No one of the test composites was clearly higher or lower than any of the others. This may be in some measure due to heterogeneity of the jobs included within a single category.

The patterns for draftsmen and surveyors showed distinct similarity. Each had its peak in the cluster of tests involving rapid and accurate visual perception. The mechanical composite was above average in both cases, but somewhat higher for the surveyors. Both groups were above average in psychomotor performance, and in each case it was the Finger Dexterity test on which they did best. Both groups were lowest on the numerical tests.

BIOGRAPHICAL DATA BLANK ITEM RESPONSES

The item responses on which engineers differ significantly from the total group of respondents are summarized in Table 13.3. Some features were common to all or almost all engineering groups, and these will be commented on first. Then attention will be directed to each group in turn, and some of the distinctive response patterns of that group will be pointed out.

Most of the engineer groups showed an above average proportion of men who had started in college before entering the Air Force. Naturally enough, the men had tended to major in physical science and engineering, and they tended to show significantly low rates of majoring in social sciences and in business. The groups were consistent in showing a high level of school participation and success in algebra, mechanical drawing, physics, and trigonometry. They tended to be low in dramatics. Engineers tended to have made flying plane models and to have had a previous history of work in engineering. They tended *not* to have been employed in auto, real estate, or wholesale sales.

Table 13.3
Significant Biographical Data Blank Item Responses for Engineers

	Chemical	Civil	Electrical	Industrial	Mechanical	Sales
General Family and Personal Background						
Lived mostly in the city				+ + +		+ + +
Many books in the home						+ + +
Many tools in the home		+ + +			+ + +	+
Had some college education	+ + +	+			+ + +	+ + +
Father graduated from high school	+ + +					+
Father of American stock	+					
Mother graduated from high school						+ + +
Mother of American stock	+ +					
Duration of interest in aviation career	— —				+ + +	
Family owned expensive car			— —		—	+ + +
Has driven or ridden motorcycle	—		— — —	— —		
Major Subject in College						
Did not attend college	— —	— —			— — —	— — —
Social sciences or philosophy	— — —	— — —		— —	— — —	
Education				—		
Business, commerce, journalism	— —	— — —	— — —		— — —	— — —
Industrial arts, physical education, agriculture				—		— —
Biological science, medicine		—				
Physical science, mathematics, engineering	+ + +	+ + +	+ + +	+ + +	+ + +	+ + +
School Subjects Studied and Done Well						
Algebra	+ + +	+ + +	+ + +		+ + +	+ + +
Dramatics	— — —	— —	— — —		— —	
Economics	— —	—	— —			
English					— — —	
Foreign languages	+ +			+ +		
History					— — —	
Mechanical drawing	+ +	+ + +	+ + +	+ + +	+ + +	+ + +
Physical training			— — —			
Physics	+ + +	+ + +	+ + +	+ + +	+ + +	+ + +
Public speaking		— —	— — —			
Shop work	— —	+	+		+ + +	
Trigonometry	+ + +	+ + +	+ + +	+ + +	+ + +	+ + +

Table 13.3 *(Continued)*

	Chemical	Civil	Electrical	Industrial	Mechanical	Sales
Sports Participated in and Done Well						
Football, rugby, soccer			– –			
Basketball, hockey, lacrosse			– – –			
Baseball, softball		–	–			
Boxing, wrestling, water polo		–	– –			
Crew, rowing, canoeing			–	+ + +		
Tennis, handball, ping-pong, badminton	+ +			+ +		+ +
Diving, ski jumping		– –				
Track (field events)		– – –	–			
Horsemanship			– –		– –	
Activities Done a Number of Times						
Adjust clock					+ +	
Write technical report	+ +			+ + +	+ + +	+ + +
Arrange club entertainment					– – –	
Write essay or poem						+ +
Interview men for job					– – –	
Arrange flower garden		– –				
Repair radio set			+ + +			+ + +
Solicit for a charity					–	
Adjust carburetor	– –			– –		
Hobbies and Free-Time Activities						
Painting, sketching				–		
Music		– –				
Collecting (stamps, etc.)	+ +			+ +		
Dramatics		– –		–		+
Creative writing		– –	–			– –
Journalism, school paper					–	
Boy Scouts	+				+	+ + +
Photography					+ +	
Woodworking, cabinet-making					+ + +	
Sheet-metal work					+ + +	+
Metal work, machine shop				+ +	+ + +	
Auto repair, rebuilding	– – –					
Build nonflying plane models			+ +	+	+ + +	+ + +
Build powered model plane		+ + +	+ + +	+ + +	+ + +	+ + +
Participate in model plane contest			+		+ + +	+ + +
Work on glider or plane					+ +	

Table 13.3 *(Continued)*

	Chemical	Civil	Electrical	Industrial	Mechanical	Sales
Work Experience						
Unskilled manual				−	+ +	
Skilled manual					+	
Minor supervisory		− − −			− −	
Engineering, drafting, surveying		+ + +	+ + +	+ + +	+ + +	+ + +
Simple clerical			− −		− − −	
Higher office work		− − −	− − −		− − −	+ + +
Sales—auto, real estate, etc.	− −	− −	− −		− − −	
Managerial		− −			− − −	
Scientific	+ + +				+ + +	
Instructor or leader			− −		−	
Reporter, lawyer, advertising	−		−			
Entertainer			−			
Protective service			− −			
No work experience		− −			− − −	− −
Reason for Choosing Cadet Training						
Love of adventure					+ + +	
Prefer duties to other branches			+ +			
To use training after war				+	+ +	
To prove can make good	− −					− −

Chemical Engineers. This group tended to have well-educated fathers and native-born mothers. They tended to be somewhat nonmechanical in that they showed up as low on shop work as a school subject, and adjusting a carburetor and repairing or rebuilding cars as activities. Some of their plus factors were foreign language, tennis, collecting, technical report writing, and work in the field of science. There is perhaps a theme of scientific and intellectual activity here. One might suggest that the chemical engineer's affiliations are more with chemistry than with mechanical and material things.

Civil Engineers. These men tended to come from homes well supplied with tools. They tended to be low on a number of items which relate to esthetic and possibly social values. These include such things as public speaking as a school subject, arranging a flower garden as an activity, and music, dramatics, and creative writing as hobbies. The group also was low on work experience in the categories of managerial, higher office, and minor supervisory.

Electrical Engineers. The engineers in this group showed no significant tendency to have had college training before the war. They were low on a number of indicators of physical skill and sports participation—football, basketball, boxing, horsemanship, motorcycle riding, and physical education in school. Work experience was low in clerical work, and also in such categories as instructor, entertainer, and protective service worker. Specific experience in making and repairing radio sets was indicated.

Industrial Engineers. The industrial engineers appeared to be a predominantly urban group in their background, and to be a group that had not tended especially to have gone to college prior to the war. There was relatively little clear pattern in the other items on which this group differed from the general respondent group.

Mechanical and Aeronautical Engineers. This group showed up high on a number of indicators of mechanical interest and experience. They tended to have had many tools in their home, to have been high on shop work in school, to have adjusted a clock, participated frequently in wood-, sheet metal-, and metalworking, have made model planes of various types, and engaged in both unskilled and skilled manual work. They were low on certain verbal and social activities, such as English and history in school, planning a club entertainment, interviewing employees, or soliciting funds for a charity. Clerical, sales, and managerial work were engaged in infrequently. They reported having early considered aviation as a career, liking an adventurous life, and planning to use their aviation skills after the war.

Sales Engineers. These men were predominantly urban. As compared to other engineers, they appeared more verbal, and this is perhaps a reflection of the fact that they tended to have well-educated parents and to come from a home with many books. Their parents appeared also to have been somewhat well-off, as reflected in ownership of a good car. In background and interests, these men appeared to have some of the characteristics of the business executive groups described in the next chapter.

Biographical item responses for the supporting groups are presented in Table 13.4. As these do not have a great deal in common, each group will be discussed separately.

Draftsmen. This was an urban group with a low amount of college background for both the men themselves and their parents. They were low on a wide variety of verbal, esthetic, athletic, and social items. Illustrative verbal-social items were school subjects such as dramatics, foreign languages, and public speaking; selling an article, arranging a club entertainment, interviewing men for a job and making a speech;

Table 13.4
Significant Biographical Data Responses for Engineering Supporting Groups

	Draftsmen	Specifications Writer, Estimator	Laboratory Technicians, Tester	Surveyor
General Family and Personal Background				
Lived mostly in the city	+ + +	+ + +	− −	+ +
Many tools in the home				+
Had some college education	− − −			
Father graduated from high school	− −	− −		
Father of American stock				− −
Mother graduated from high school	− − −			
Mother of American stock				− −
Duration of interest in aviation career	+ + +	+ +		
Family owned expensive car			− −	−
Has driven or ridden motorcycle	− −		−	
Major Subject in College				
Did not attend college	+ + +	+	+ + +	
Social sciences or philosophy	−		− −	
Education	−			
Business, commerce, journalism	− − −			
Industrial arts, physical education, agriculture	−			
Biological science, medicine	− −			
Physical science, mathematics, engineering	+	+		
School Subjects Studied and Done Well				
Algebra	−			
Dramatics	− − −			−
Economics	−			
Foreign languages	− − −			
History			−	−
Mechanical drawing	+ + +	+ + +		+
Physics		+ + +		
Public speaking	− − −			
Shop work	+ + +		+ +	+
Trigonometry	+ +	+ + +		

Table 13.4 *(Continued)*

	Draftsmen	Specifications Writer, Estimator	Laboratory Technicians, Tester	Surveyor
Sports Participated in and Done Well				
Football, rugby, soccer	– –			
Crew, rowing, canoeing			– –	
Tennis, handball, ping-pong, badminton	– –	+ +		
Sailboating			–	
Auto, motorcycle, motorboat racing				+ +
Track (field events)			+	
Horsemanship	– –			
Activities Done a Number of Times				
Sell article to customer	– – –			
Write technical report		+ + +		
Arrange club entertainment	– – –		– –	
Write essay or poem		+		
Interview men for job	– –		–	
Repair radio set		+ +		
Make a speech	– – –			
Hobbies and Free-Time Activities				
Amusements (dancing, movies)			– –	–
Painting, sketching	+ + +			
Music	– –			
Collecting (stamps, etc.)	+			
Dramatics	– –			
Creative writing		–		
Journalism, school paper	– – –		– –	
Amateur motion pictures		+ +		
Woodworking, cabinetmaking	+			
Sheet-metal work	+ + +			
Metal work, machine shop	+ + +	+		+
Build nonflying plane models	+ +	+ +		
Build powered model plane	+ + +			
Participate in model plane contest	+ +			+
Work on glider or plane	+ + +			

Table 13.4 *(Continued)*

	Drafts-men	Specifications Writer, Estimator	Laboratory Technicians, Tester	Sur-veyor
Work Experience				
Unskilled manual	− − −		+	
Semi-skilled manual	− −			
Skilled manual	+			
Minor supervisory	−	− −	−	
Engineering, drafting, surveying	+ + +	+ + +		+ + +
Simple clerical	− − −			
Higher office work	− − −			
Sales clerk, canvasser	− −			
Sales—auto, real estate, etc.	− −			
Managerial			− −	
Academic	− −			
Scientific			+	
Instructor or leader	− − −			−
Personal service			−	+ +
No work experience			+	
Reason for Choosing Cadet Training				
Prefer duties to other branches		+		
Better pay than other branches	− −			

hobbies in dramatics or journalism; work in clerical, sales, and academic fields. There was some tendency to be high on handicraft activities—wood- and sheet metal work, model plane building, and possibly painting. The men reported frequent prewar participation in engineering work (including drafting) and an early interest in aviation as a career.

Specifications Writers and Estimators. These men did not show a great many significant Biographical Data Blank item responses (7 out of about 115 significant at 0.01 level and 7 more at 0.05 level), so that one does not get a very clear impression of a group pattern. The group tended to be urban. It showed high educational participation and success in such scientific and technical subjects as physics, trigonometry, and mechanical drawing. The men tended to show interest and participation in a few thing-oriented activities and hobbies aviation as a career, repairing a radio, amateur motion pictures, metalworking, model plane building. They had written technical reports and worked in engineering types of jobs.

Laboratory Technicians and Testers, Surveyors. For both of these groups, the number of significant item responses was only about what could have arisen by chance. The items are shown in the table for examination by interested readers, but no interpretation will be attempted.

SUMMARY STATEMENT

In this chapter, data have been presented for engineers and for certain subengineering and technical occupations. The summary statement will comment first on the general characteristics of engineers, then on the distinctive characteristics of the engineering subgroups, and finally on the picture obtained for the subengineering groups

Engineers in General. Test scores were all above average, with the highest peak for mathematics. Considering the broader groupings of tests, it was primarily on the intellectual tests that the engineers were outstanding. They tended to have had prewar college education, majoring in physical science and engineering, and to have done well in mathematics and science courses in school. In most groups there was some indication of a low level of social participation.

Chemical Engineers. These men were very outstanding in general intellectual tests and were also the highest of the engineering groups on number tests. Their activity background tended to show an intellectual rather than a mechanical slant.

Civil Engineers. This group was quite high on general intellectual measures and was the highest of the engineering groups on the perceptual-spatial measures. The group appeared low on esthetic and social interest, and perhaps somewhat thing-oriented.

Electrical Engineers. These men were the lowest of any of the engineering groups on numerical and perceptual tests. They did relatively well on intellectual and mechanical measures. They had less prewar education than most of the engineering groups. There were a number of indications of low participation in sports. An early interest in radio was found.

Industrial Engineers. This was the lowest of the engineering groups in intellectual, mechanical, and psychomotor tests. Their performance on numerical and perceptual-spatial tests was relatively good. Their prewar collegiate background was less than for most engineering groups.

Mechanical and Aeronautical Engineers. Men in this group were high on the intellectual and the perceptual-spatial tests, and were the highest engineering group on the mechanical tests. Their biographical backgrounds indicated high participation in a number of mechanical activities, and relatively low frequency of occurrence of a number of clerical, verbal, and social activities. The level of interest in aviation appeared to be high for this group.

Sales Engineers. This was a capable group, with no special strengths or weaknesses. Relative to other engineering groups, their performance in intellectual measures was less outstanding, and their performance on most of the rest of the tests quite high. They tended to come from financially comfortable urban homes, and to be more verbal and sociable than most of the other engineer groups.

Draftsmen. These men showed their best test performance on the perceptual-spatial tests, and their poorest on the number. In background, they were low on a wide variety of verbal, esthetic, athletic, and social items. There was some indication of interest in things done with the hands.

Specifications Writers and Estimators. Men in this group gave a flat test profile at about the average of the total cadet applicant group. Both academic success and background of activities tended to be technical and thing-oriented.

Laboratory Technicians and Testers. A very flat test profile was obtained for this group at about the average of the`cadet applicant population, and there were few significant background characteristics.

Surveyors. The small group of surveyors was above average in perceptual-spatial and mechanical tests, and below in general intellectual and numerical ones. The group was too small to yield any significant information on biographical items.

CHAPTER 14

Business Executive and Managerial Occupations

The occupational groups reported on in this chapter are those that represent executive, administrative, and supervisory functions in business, industry, and public service. The persons included tended to be in the top management of small companies, or in the intermediate management of larger companies. In addition, a group of officials in public service is included. First-line supervisors are considered in Chapter 21.

DEFINITION OF GROUPS

Eleven categories of managers were separated out for analysis. A paragraph is devoted to the description of each group.

President, Vice President, or Secretary. These men held jobs in companies with one of the three above titles. The DOT codes included in the group were 0–97.01, President; 0–97.02, Vice President; and 0–97.03, Secretary. Of the 164 men in the group, roughly 20% were presidents, 30% vice presidents, and 50% secretaries. The companies tended to be rather small ones, and the men in the group reported average monthly earnings of $831. The range of incomes was rather great, as evidenced by a standard deviation of $431. The men reported working in the occupation for slightly over 7 years, on the average.

Office Manager, Chief Clerk. This grouping was made up of men coming under the two DOT codes 0-97.12, Office Manager, and 0-97.13, Chief Clerk. The work in these two categories can be described as general coordination and supervision of clerical activities and personnel in a company. The jobs under the two codes appear quite similar, though that of office manager appears generally to involve a smaller group of subordinates. Roughly ³/₄ of the men in this group were classed as office managers. For the 133 men in the group the average monthly income was $507, with a standard deviation of $130. The men had averaged slightly less than 7 years in the occupation.

Industrial, Branch or Service Manager. This grouping included men falling in three DOT codes. Industrial manager (0-97.41), including the titles of general manager, plant manager, or superintendent, designates the person having general administrative responsibility for the activities of a factory or other major production unit. Branch manager (0-97.45) represents a level of responsibility in a large industrial organization one step further down the "chain of command" than a general manager. About ²/₃ of our men were classed as industrial managers and ¹/₃ as branch managers. There were also a few service managers (0-97.47) concerned with supervision of service provided by a company to its dealers or customers. There were 177 men in this job grouping, all told, whose average monthly income was reported as $784, with the large standard deviation of $512. The group clearly included a few individuals with very large earnings. The men reported working in their occupation for almost 7½ years, on the average.

Production Manager. This grouping included only a single DOT code, 0-97.51, Production Manager, though the actual job probably varied quite widely, depending upon the particular product that was being produced. This job is more restricted in scope than that of a general manager and is focused on supervision of actual production activities in a plant or part thereof. The production manager is a second- or third-line supervisor of the production worker. Our sample included 107 of these men, reporting an average income of $707 per month, with a standard deviation of $358. They had been working in their job for a little more than 7 years.

Managerial Directing Production. This group included a number of DOT codes for supervisors of various types of construction, mining, drilling, and maintenance activities. Titles that appeared for a number of individuals were roughly in order of frequency, 0-99.11, Construction Superintendent; 0-97.56, Maintenance Superintendent; 0-99.05, Manager, Extraction of Minerals; and 0-97.57, General Foreman. These represent supervisory responsibilities largely outside of the conventional factory setting. The general type and level of responsibility appear to be roughly comparable to that in the previous group, though reported income was somewhat lower. These men reported an average monthly income of $591, with a standard deviation of $233. They had spent an average of approximately 7 years in their occupations.

Personnel or Employment Manager. This grouping covered the DOT codes 0-39.80 through 0-39.89, for which the heading is Personnel and Employment Managers. Jobs under this heading are concerned with handling some aspects of the employment, training, welfare, or company policies with respect to its employees. Specific codes occurring with some frequency were 0-39.81, Educational Director; 0-39.82, Employment Manager; and 0-39.83, Personnel Manager. For the 66 men in this group the average monthly income was $609, with a standard deviation of $171. The men had averaged a little more than 6 years in the occupation.

Industrial Relations Specialist. The men in this group were primarily men in some specialized aspect of personnel work. About half of the group were time-study men (0-68.73), concerned with observing and recording the time to perform industrial operations. The group also included 0-68.71, Employment Interviewer; 0-68.76, Labor-Relations Specialist; and 0-68.70, Manager of Industrial Relations. The positions for these 43 men were rather less well-paid than those in the previous group, to which it seems to be closely related. The mean was $478, and the standard deviation $95. Average time in the occupation was only about 5 years.

Managerial, Transportation, and Warehousing. This group included a large number of specific occupations having to do with the management and administration of airports, terminals, and warehouses. It encompassed the range of DOT codes from 0-98.62 to 0-98.95, and in addition 0-97.66, 0-99.72, and 0-99.92. Representative titles, illustrating the range included in the group, are shown listed below:

0-98.62	Superintendent, transportation
0-98.73	Yardmaster (RR)
0-98.81	Superintendent, airport
0-98.84	Superintendent, terminal (water)
0-98.86	Superintendent, maintenance (air transportation)
0-98.92	Manager, traffic
0-99.72	Manager, bulk plant (petroleum)
0-99.92	Manager, warehouse

There were 91 men in the group. The average monthly income reported by the men was $530, with a standard deviation of $209. Average time in the occupation was slightly less than 7 years.

Administrative Manager, Miscellaneous. This was a very heterogeneous group of managerial jobs. Several had to do with oil production, such as 0-98.22, Leasing Manager; and 0-97.65, Contracts Manager. A number of others were related to motion pictures, radio and television, including 0-97.74, Program Director; 0-97.84, Producer; and 0-99.46, Station Manager. Others had to do with welfare organizations and institutions, as represented by 0-99.80, Social Welfare Administrator; and 0-99.84, Institution Manager. Thus, the group was made up of many types of administrative odds and ends, not well provided for elsewhere. Mean monthly income for the group of 55 men was $676, with a standard deviation of $559. Thus, two or three men classed in this group apparently reported very high incomes. Average time in the occupation was somewhat under 6½ years.

Advertising Agent. This group corresponded to the DOT 3-digit category 0-81, Advertising Agents. Most of our men were classed either as 0-81.02, Advertising Manager; or as 0-81.03, Manager of an Advertising Agency. These two groups are both concerned with the direction and supervision of advertising programs, one from the viewpoint of the company whose products or services are being advertised and the other from the point of view of the organization that devises and places the advertising. There were 38 advertising agents in our sample. They reported an average monthly income of $738, with a standard deviation of $347, and had been working in the occupation for approximately 7 years.

Minor Official or Agent. The final group considered in this chapter included a rather wide range of minor officials and agents. The occupations were those included in DOT code groups 0-79, 0-94, and 0-95. Illustrative occupations that occurred several times each in the group of 67 men are 0-79.01, Construction Inspector; 0-94.61, Tax Collector; 0-94.62, Assessor; and 0-94.99, Postmaster. Clearly, this was quite a heterogeneous group of jobs whose incumbents were filling a variety of public positions, with a modest degree of responsibility. The average monthly income for these 67 men was $421, with a standard deviation of $97, and the average length of time in the occupation was slightly over 6½ years.

GROUP MEAN SCORE PROFILES

Mean standard score profiles for the eleven business executive and management groups are shown in Table 14.1.

Table 14.1
Mean Standard Score Profiles of Business Executives and Managers

	President, Vice President, Secretary	Office Manager	Industrial Branch Manager	Production Manager	Manager Directing Production
Reading Comprehension	27	−10	0	25	24
General Information—Navigator	28	1	10	25	4
Mathematics	39	10	6	29	16
Arithmetic Reasoning	29	10	17	21	16
Numerical Operations I	14	33	17	28	−12
Numerical Operations II	8	20	13	23	2
Dial and Table Reading	28	29	21	31	12
Speed of Identification	1	10	−2	−2	13
Spatial Orientation I	24	14	−14	9	9
Spatial Orientation II	9	−4	−10	4	21
Mechanical Principles	−4	−30	5	2	19
General Information—Pilot	3	2	3	5	12
Two-Hand Coordination	8	−8	15	7	6
Complex Coordination	18	6	8	17	16
Rotary Pursuit	2	4	11	6	−3
Finger Dexterity	17	11	17	20	11
Aiming Stress	15	7	−7	−5	−16
Discrimination Reaction Time	19	13	8	15	8
Biographical Data—Pilot	9	−28	18	−3	24
Biographical Data—Navigator	35	1	1	15	4
N	164	133	177	107	114

An examination of rank-difference correlations among the profiles indicates that four of the groups had quite similar profiles. These four groups and the correlations among them are shown below.

	2	3	4
1. Personnel, employment manager	0.74	0.69	0.68
2. President, vice president, secretary		0.44	0.65
3. Industrial relations specialist			0.63
4. Production manager			

The profiles for the other seven groups showed relatively little resemblance to the members of this cluster or to each other. In general, these groups tended to have rather flat profiles, and the variations between different subgroups may have been in large part chance matters.

Table 14.1 *(Continued)*

	Personnel Employment Manager	Industrial Relations Specialist	Manager Transportation, Warehousing	Manager Miscellaneous Administrative	Advertising Agent	Minor Officials
Reading Comprehension	5	25	−10	−1	45	−19
General Information—Navigator	24	39	−7	14	27	−16
Mathematics	42	38	−11	−9	11	−13
Arithmetic Reasoning	30	37	6	−11	−2	2
Numerical Operations I	14	22	24	−21	−27	−23
Numerical Operations II	12	24	17	−17	−25	1
Dial and Table Reading	18	16	18	8	22	−20
Speed of Identification	2	10	12	12	20	−2
Spatial Orientation I	12	12	11	−11	50	−10
Spatial Orientation II	16	29	−13	−3	9	−8
Mechanical Principles	−24	8	−24	−10	−36	−16
General Information—Pilot	11	29	12	13	−20	−11
Two-Hand Coordination	−7	15	−15	−24	6	−11
Complex Coordination	5	23	−2	−30	2	−16
Rotary Pursuit	−2	2	−22	−33	−16	−17
Finger Dexterity	8	12	−11	−28	5	20
Aiming Stress	−21	−8	−12	−3	−22	−9
Discrimination Reaction Time	14	7	3	−11	28	−30
Biographical Data—Pilot	−15	−12	−11	4	−3	−14
Biographical Data—Navigator	30	15	−7	19	35	7
N	66	43	91	55	38	67

The main pattern in the several subgroups can be brought out, at the expense of some loss in detail, by pooling groups of related tests. As in the previous chapters, five test composites have been computed, each expressed in the same standard score units (mean = 0, S.D. = 100) that were used for the separate tests. For the four groups showing rather similar profiles, the pattern is as follows:

	President, Vice President, Secretary	Production Manager	Personnel, Employment Manager	Industrial Relations Specialist
General intellectual	40	32	33	45
Numerical	20	33	18	25
Perceptual-spatial	15	5	13	22
Mechanical	6	3	−20	5
Psychomotor	20	14	−4	11

All these groups had in common a moderate peak in the general intellectual factor, and all were lowest on the mechanical composite. They were consistent in showing somewhat above average numerical ability. The perceptual-spatial composite tended to be slightly above average, whereas psychomotor performance varied from somewhat above to very slightly below average.

The other seven groups discussed in this chapter showed profiles that had little in common or in common with the pattern exhibited above. The condensed profiles are exhibited below and considered individually.

	Office Manager	Industrial Branch Manager	Manager Directing Production	Manager Transportation Warehousing	Miscellaneous Manager	Advertising Agent	Minor Officials
General intellectual	4	11	19	−7	−2	26	−15
Numerical	33	20	1	24	−12	−12	−17
Perceptual-spatial	9	−11	17	4	−10	34	−9
Mechanical	−29	17	22	−22	−13	−15	−18
Psychomotor	11	11	3	−18	−35	−12	−8

Office managers were fairly high on numerical ability and quite low on the mechanical composite. In this, they resembled accountants, though they appeared to be a somewhat less able group.

The general managers and branch managers for industry presented a very flat profile. Its only distinctive feature was a slight deficit on the perceptual-spatial tests. In general, we would have to say that we can identify no aptitudes that distinctively characterize this group of plant and branch managers. They appeared generally a little above the average of the total cadet group.

The category Managerial Directing Production, which included such jobs as construction superintendent or drilling superintendent, also showed a generally flat and undifferentiated profile. There was a suggestion of greater strength in the mechanical than in the numerical, and the somewhat above average mechanical score appeared together with somewhat above average intellectual ability.

The group of managers with supervisory responsibility for airports, marine terminals, railway yards, warehouses, and transportation for a company showed greatest strength on the numerical tests and did least well on the mechanical and psychomotor composites. It appears that this job called more for dealing with figures than for dealing with things.

The catchall miscellaneous managerial group was made up of individuals a little below the cadet average in most of the abilities measured by our tests. There was a fairly marked deficiency in the psychomotor tests.

Advertising agents showed above average performance on the general intellectual composite. This stemmed primarily from good performance on the verbal tests. Good verbal ability was combined with above average performance on the perceptual composite. There is a suggestion here that the advertising man needs some of the same talents for visual perception that characterize the architect and designer.

The group of minor officials showed an almost completely undifferentiated profile, with slightly below average performance on all the test composites.

BIOGRAPHICAL DATA ITEM RESPONSES

The responses with respect to which the managerial groups differed from our total respondent population are summarized in Tables 14.2 and 14.3. Table 14.2 presents data for three of the four occupational groups that were found to have rather similar ability profiles. Six other groups are described in Table 14.3. The groups of industrial relations specialists and of managers in transportation and warehousing showed so few percentages significantly different from the total group of respondents that an attempt to report and interpret them did not seem justified.

Although the three groups covered in Table 14.2 were quite similar in ability profiles, they did not show very similar results on the biographical items. For this reason, it seems necessary to discuss each group separately.

The presidents, vice presidents, and secretaries showed a distinctive pattern on many of the biographical items. To begin with, they tended to be urban and to have favorable family backgrounds. Their homes were likely to be characterized by many books, well-educated native-born parents, and comfortable circumstances. Many of the men had completed some college before entering the Air Force, tending to major in social sciences and business. In school they showed a high proportion doing well in economics, English, and public speaking, and they reported relatively frequently that they had engaged in writing and speaking activities. They were below average on some of the mechanical activities and hobbies. Thus, they appeared to be a verbal and somewhat nonmechanical group a finding that is consistent with their ability pattern. Since this group showed a high frequency of successful participation in a number of sports, they appeared to have some motor

Table 14.2

Significant Biographical Data Item Responses for Three Managerial Categories with Similar Ability Profiles

	President, Vice President, Secretary	Production Manager	Personnel, Employment Manager
General Family and Personal Background			
Lived mostly in the city	+ + +		
Many books in the home	+ + +		+
Had some college education	+ + +	+ + +	+ + +
Father graduated from high school	+ + +		+ +
Father of American Stock	+		
Mother graduated from high school	+ + +	+	+ +
Mother of American stock	+		
Duration of interest in aviation career			–
Family owned expensive car	+ + +	+ + +	
Is a good safe driver		+	
Has driven or ridden motorcycle	+		–
Family or close friend has been a pilot	+ + +		
Major Subject in College			
Did not attend college	– – –	–	– – –
Social sciences or philosophy	+ + +		+
Business, commerce, journalism	+ + +		
Physical science, mathematics, engineering	+	+ + +	
School Subjects Studied and Done Well			
Algebra		+ + +	
Dramatics		– – –	+
Economics	+ + +		
English	+ + +		
Foreign languages			+
Public speaking	+ + +		+ + +
Shop work	– –		
Trigonometry	+ +	+ + +	
Sports Participated in and Done Well			
Boxing, wrestling, water polo	+ + +		
Crew, rowing, canoeing	+ + +		
Tennis, handball, ping-pong, badminton	+ + +		
Sailboating	+ + +		
Auto, motorcycle, motorboat racing	+ + +		
Swimming	+ + +		+ +
Track (dashes, hurdles)		–	+

Table 14.2 *(Continued)*

	President, Vice President, Secretary	Production Manager	Personnel, Employment Manager
Track (longer races)		−	+
Track (field events)	+		
Horsemanship		+	
Activities Done a Number of Times			
Adjust clock	−		
Write technical report	+	+	
Arrange club entertainment	+ + +		
Write essay or poem	+		+ +
Interview men for job	+ + +		
Arrange flower garden	−		
Repair radio set	−		
Make a speech	+ + +		+ + +
Adjust carburetor	−		
Hobbies and Free-Time Activities			
Amusements (dancing, movies)	−		
Dramatics	+		+ + +
Creative writing	+		
Journalism, school paper			+ + +
Boy Scouts			+
Woodworking, cabinetmaking	−		
Sheet-metal work	− −		
Metal work, machine shop	− −		−
Work Experience			
Semi-skilled manual	− − −		
Skilled manual	− −	+ +	
Higher office work	+ + +		+ + +
Managerial	+ + +		
Instructor or leader	+ +		+
Semi-professional	+		
Reporter, lawyer, advertising	+ + +		
Entertainer			+ +
Reason for Choosing Cadet Training			
Prefer duties to other branches	+	+ +	
Better pay than other branches		+ +	
To use training after war		−	

talents. However, the sports that they participated in were to some extent "class" sports rather than "mass" sports—i.e., canoeing, tennis, sailboating, swimming. Their achievement here may have reflected the opportunities that their background provided as much as it did their special skills. Even before entering the Air Force, they had frequently had work experience in higher level occupations—higher level office work, managerial, public relations—and had interviewed prospective employees. Thus, they appeared to have gotten off to an early head start in the world of work.

Production managers showed a much smaller number of distinctive features in their personal background. They tended to come from families with good cars, and to have made a start on collegiate education prior to entering military service. College major was often physical science or engineering, and their outstanding school success was in mathematics courses. They reported an excess of work experience in skilled manual occupations, and said that they entered the Air Force because of the higher pay and liking for the work. However, the total background picture was a rather average one.

Personnel and employment managers tended to be college-educated young men coming from homes with more than average education. They showed high participation in a number of writing and speaking activities. They had engaged in higher office work and to some extent in work as entertainers before entering the Air Force.

Turning now to the six groups whose responses are summarized in Table 14.3, we shall consider first the office managers. The characterization of this group tends to be primarily negative. They had *not* been very active or successful participators in sports, especially of the contact or adventurous variety, and they had *not* gone in for things of a mechanical nature. In these respects, they were like accountants and exhibited what we might call the "clerical syndrome." On the positive side, they had frequently done well in economics and English, and worked in higher level office work prior to their entry into the Air Force.

Industrial general managers and branch managers looked a good deal like the top company executives. They came from urban homes with many books and an expensive car, but this group also reported many tools. They had had some college, with business and physical science majors both frequent. They reported success not only with economics and English, but also with trigonometry. They were successful participators in baseball and tennis. They reported relatively frequent experience in some business, some verbal, and some mechanical activities. Thus, they had frequently written a technical report, arranged a club entertainment, interviewed men for a job, and fixed a

Table 14.3
Significant Biographical Data Item Responses for Six Managerial and Administrative Groups

	Office Manager	Industrial Branch Manager	Manager Director Production	Manager Miscellaneous	Advertising Agent	Minor Officials
General Family and Personal Background						
Lived mostly in the city		+ + +			+ + +	− − −
Many books in the home		+ + +			+ +	
Many tools in the home		+ + +	+		−	−
Had some college education		+ + +	−		+ +	
Father graduated from high school			−	+ +	+	
Father of American stock			+ +			
Mother graduated from high school		+				
Parents strongly favored joining Air Force			+ +			
Duration of interest in aviation career	− −					
Family owned expensive car		+ + +	+ +			
Has driven or ridden motorcycle	− −					+
Family or close friend has been a pilot		+ + +		+ +		+ + +
Major Subject in College						
Did not attend college		− − −			− −	
Social sciences or philosophy			−			
Business, commerce, journalism		+ + +			+	
Biological science, medicine				+ + +		
Physical science, mathematics, engineering		+ + +				
School Subjects Studied and Done Well						
Dramatics				+ + +	+ +	
Economics	+ +	+ +	− −			
English	+ +	+				
Foreign languages				+ +		
History				+ + +		
Mechanical drawing			+			− −
Music					+	− −
Physical training			+			
Physics			+ + +			

Table 14.3 *(Continued)*

	Office Manager	Industrial Branch Manager	Manager Director Production	Manager Miscellaneous	Advertising Agent	Minor Officials
Public speaking					+ + +	
Shop work	− − −		+ +			− −
Trigonometry		+ +				
Sports Participated in and Done Well						
Football, rugby, soccer	− −					
Basketball, hockey, lacrosse	−					
Baseball, soft ball						
Boxing, wrestling, water polo		+ + +	+ + +			
Crew, rowing, canoeing			+ +	+		
Tennis, handball, ping-pong, badminton			+			− −
Diving, ski jumping	− −	+ +				
Marksmanship						
Sailboating	−	+	+ + +	+		
Auto, motorcycle, motor-boat racing	− −				+ + +	
Swimming						
Track (dashes, hurdles)			+ + +		+	
Track (longer races)					+	
Horsemanship	− −		+ + +	+ + +	+ + +	+ +
Activities Done a Number of Times						
Sell article to customer						
Write technical report	−	+				
Arrange club entertainment	−	+ + +	+ +		+	
Write essay or poem		+ + +		+ + +	+	
Interview men for job				+ +	+ + +	
Arrange flower garden		+ + +				
Repair radio set			+ + +		− −	
Solicit for a charity				+ +		
Make a speech				−		
Adjust carburetor		+ + +	+	+ +		
Hobbies and Free-Time Activities						
Amusements (dancing, movies)	+					
Painting, sketching						
Music					+	
Collecting (stamps, etc.)		+ +	−			− −

Table 14.3 *(Continued)*

	Office Manager	Industrial Branch Manager	Manager Director Production	Manager Miscellaneous	Advertising Agent	Minor Officials
Dramatics				+ + +		
Creative writing	– –				+ + +	
Journalism, school paper	+	+ +	– –	+ +	+ + +	
Amateur motion pictures				+		
Woodworking, cabinet-making			+ +	– –		
Sheet-metal work	–				–	
Metal work, machine shop	– – –					
Auto repair, rebuilding		+ + +		– –		
Build nonflying plane models			+			
Build powered model plane					+	
Participate in model plane contest		+ +				
Work on glider or plane				+ +		
Work Experience						
Unskilled manual			–		– –	
Semi-skilled manual						– –
Skilled manual		+ +	+ + +		–	
Minor supervisory		+ + +	+	–		
Engineering, drafting, surveying		+ +	+ + +			
Simple clerical					+ +	
Higher office work	+ + +			–		+ +
Sales clerk, canvasser					+ +	
Sales—auto, real estate, etc.		+ + +				
Managerial		+ + +			+	+ +
Instructor or leader	–		+ +		+ + +	
Semi-professional		+ + +				
Reporter, lawyer, advertising				+ +	+ + +	+
Personal service		– –		– –		
Entertainer		+ +				
Protective service						–
Reason for Choosing Cadet Training						
Feel have aptitude		+ +			– – –	–
Prefer duties to other branches					–	

carburetor. Hobby activities had emphasized journalism and auto repairing. Work experience was relatively extensive in the skilled manual, supervisory, engineering, sales, managerial, and semi-professional groups. The impression these men give is of a rather varied and versatile group.

The managerial group directing production in such fields as construction, mining, and well drilling showed up as participators in a wide variety of outdoor sports—baseball, shooting, swimming, and riding. They appeared to be active, outdoor individuals. Their academic success was concentrated in the technical and mechanical, and their work experience was also focused on skilled manual and engineering types of activities. There was some suggestion of infrequent participation in verbal kinds of activities.

One would not expect the miscellaneous managerial group to present a very clear-cut picture, and in fact it did not. In general, the men appeared to be distinguished on verbal rather than mechanical items. The group was high on dramatics, foreign languages, and history as school subjects, on arranging an entertainment, writing an essay or poem, making a speech, dramatics, and journalism as activities. It was low on woodworking and auto repairing. Prewar work experience was high in the public relations group.

Advertising agents came from a predominantly urban background with books in the home. Tending to be well-educated and to have fathers with more than average education, they showed strongly verbal activity backgrounds. Public speaking in school, and writing and journalism as free-time activities appeared frequently in this group. Their work experience was low in unskilled and skilled manual, but high in clerical, sales, managerial, group leader, and public relations. Relatively few of these men mentioned special aptitude for flying or a preference for flying duties as a reason for entering the Air Force.

By contrast with many of the groups considered in this chapter, the minor officials were a predominantly rural group. Not outstanding in education or in any aspect of school work, they were definitely low in mechanical drawing, music, and shop work. They had had frequent personal contacts with fliers. They were relatively high in reported experience in higher office work and work of a managerial character. However, the number of items on which they showed significant differences was quite small, and the pattern cannot be interpreted with assurance.

SUMMARY STATEMENT

In this chapter we have presented data on 11 managerial and supervisory occupations. These varied widely in level and type, extending from corporation presidents to minor officials in public service. At this point we shall try to summarize in a sentence or two the picture presented by each group, though such a brief summary must necessarily be incomplete and imperfect.

Presidents, Vice Presidents, and Secretaries. Coming from economically privileged urban homes and relatively well-educated, these men engaged successfully in various verbal activities, as well as in sports characteristic of persons of some means. Their verbal activities were accompanied by a modest peak on the general intellectual composite of the ability tests.

Office Managers. These men tended to be nonathletic and nonmechanical in their activities. Their test scores showed a decided low point on the mechanical test composite. Their strong point was in numerical ability.

Industrial and Branch Managers. In family background, these men were somewhat like the top executive group, coming from comfortable urban homes. However, they tended to be somewhat more mechanical, as evidenced both by their activities and their test scores. They showed a generally flat ability profile.

Production Managers. The outstanding abilities in this group were numerical and general intellectual. The activities in which they were outstanding tended to be technical and mechanical to some extent.

Managers Directing Production. Working in construction, mining, and so forth, these men tended to be participants in a wide range of outdoor activities. They showed up as more technical and mechanical than other managerial groups, though their ability profile was quite a flat one.

Personnel and Employment Managers. This group showed a pattern of high intellectual and low mechanical scores. The activities in which they were outstanding tended also to be verbal and social ones.

Industrial Relations Specialists. The pattern of high scores on general intellectual tests and low mechanical scores was repeated in this group. No clear-cut activity patterns could be identified.

Transportation and Warehousing Managers. These men showed a relatively flat ability profile, but with some peak in the numerical tests, and a hollow for the mechanical and psychomotor composites. Significant biographical data items were too few in number to justify any analysis.

Miscellaneous Managerial. This group showed a flat low-average profile, with a deficit on psychomotor tests. They were high on a number of writing and speaking activities, and somewhat low on mechanical ones.

Advertising Agents. The ability pattern showed peaks on verbal tests and those involving visual perception. Urban in background, this group had frequent participation in a number of verbal activities and verbal and interpersonal types of work experiences.

Minor Officials. This predominantly rural group provided little of a distinctive nature either in ability or activity patterns. Their slightly below average test scores were quite uniform for the different composites, and little of interest emerged from the biographical items.

CHAPTER 15

Commercial and Retail Sales Occupations

This chapter reports findings for eight groups of occupations that are generally concerned with buying and selling. Three of these are direct consumer contact occupations—owner or manager of a retail store, of a hotel, motel, restaurant or bar, or of a service or recreation establishment. The others involve buying and selling in business, or activities that relate to it—wholesaler, buyer, purchasing agent, credit manager, and manager of an insurance office. A number of other selling jobs, including the jobs of wholesale salesmen, are covered in the following chapter. The division is admittedly somewhat arbitrary, and these two chapters should perhaps be read as a unit.

DEFINITION OF GROUPS

Manager or Owner of Retail Store. This grouping covered the same range of occupations as the 3-digit DOT code 0–72, Retail Managers. All kinds of retail outlets were included, from clothing to lumber. Specific codes that were quite frequent in our population were 0–72.01, Apparel; 0–72.11, Autos; 0–72.12, Auto Service; 0–72.21, Food; 0–72.51, General Merchandise; 0–72.71, Hardware; 0–72.72, Lumber and Building Supplies; 0–72.81, House Furnishings; and 0–72.82, Household Appliances. In our analysis, no distinction was made between owners and employed managers of stores. The group was a large one, including 522 men, and was also probably quite heterogeneous, in view of the range of types, sizes, and locations of stores that were included. It is possible that some further breakdown of the group would have been desirable, but this was not attempted. The men in this group reported an average monthly income of $611, but they were quite variable in income. The standard deviation was $364. Average time in the occupation was approximately 7½ years.

Manager of Hotel, Motel, Restaurant, or Bar. This group coincided with the DOT 3-digit code 0–71, Hotel and Restaurant Managers. At least half of the group were classified 0–71.23, Restaurant Manager; and about one-fourth 0–71.13, Hotel or Motel Manager. A few were classified 0–71.21, Manager of Cafeteria or Lunchroom or 0–71.30, Manager of Liquor Establishment. The group numbered 69 in all. Average reported monthly income was $577, with a standard deviation of $217. The men reported having worked in this occupation for somewhat under 6½ years, on the average.

Manager of Service or Recreation Establishment. Most of the men in this group fell within DOT code 0–98.41, Manager, Service Establishment. The description of this occupation is given as "supervises the activities of an institution that renders service to the public, such as a business-service, repair-service, or personal-service establishment." It is probable that the services offered by members of this group were quite varied, but the nature of our coding does not permit us to determine how many were involved in what kinds of service. A much smaller number were coded 0–98.54, Manager, Recreation Establishment. This included managers of theaters, bowling alleys, pool halls, and enterprises of this general type. There were 103 men in these two categories, who reported an average monthly income of $559. The standard deviation was $230. Average time in the occupation was reported as almost 8 years.

Wholesaler. Practically all of the men in this group fell under the DOT code 0–73.01, Wholesaler. As the name indicates, this category refers to men who direct an enterprise involving buying from manufacturers or producers and selling to retailers. The trading may be in any type of product. The group also included a small number classed as 0–73.10, Warehouse Manager. Average monthly income reported by the 85 men in this group was $669, with a standard deviation of $298, and the men had been in the occupation for somewhat over 7½ years, on the average.

Buyer, Retail Department Manager, or Floor Manager. This group was made up of several categories of responsible personnel in large retail establishments. The group included the DOT 3-digit codes 0–74, Buyer and Department Head, Store and 0–75, Floorman and Floor Manager. The specific codes that occurred most frequently and accounted for most of the group were 0–74.11, Buyer; 0–74.13, Department Manager; and 0–74.21, Merchandise Manager. The merchandise manager has general supervisory responsibility for buying and selling of merchandise in a retail establishment. Buyers and department managers operate under his general supervision, the one concerned primarily with buying and pricing, the other with operating a department. Our population contained 62 men in the occupations which fell into this group. They reported an average income of $578, but the standard deviation of $409 indicates that a few men had quite high incomes. Average time in the occupation was somewhat less than 7½ years.

Purchasing Agent, Broker, or Commodity Buyer. This grouping was made up about 70% of 0–91.60, Purchasing Agent, whose job was to purchase materials for consumption by an organization rather than for resale. There were also a few classified as 0–91.63, Grain Buyer; and as 0–91.80, Broker. The grain buyer manages a grain elevator and supervises purchases of grain. The broker, as the term is used here, purchases some type of commodity for resale. Typical commodities are produce, livestock, and second-hand furniture. Brokers and commodity buyers differ from purchasing agents in that they handle not only purchasing but also resale. Among our respondents we found 96 men falling in this grouping. They reported an average monthly income of $540 with a standard deviation of $194. Average time spent in the occupation was about 6½ years.

Credit Manager. The men in this grouping were all coded as 0–85.10, Manager, Credit and Collection. This job is to supervise the extending of credit by a store or other type of business concern and direct the procedures for collecting on overdue accounts. Our respondents included 46 men in this rather specific occupation, who had spent an average of slightly over 7 years in it. The men reported an average monthly income of $501, with a standard deviation of $197.

Insurance Manager. With one or two exceptions, the men in this occupation fell under DOT code 0–98.07, Manager, Insurance Office. They were in charge of an insurance company's branch or district office, where they were in charge of employing and supervising salesmen and of the general management of the office. There were in the group also one or two persons coded as 0–98.10, Manager, Insurance and 0–98.11, Manager, Insurance Department. The former was in

Table 15.1
Mean Standard Score Profile for Managers of Retail Stores, Hotels and Restaurants, and Service and Recreation Establishments

	Manager Retail Store	Manager Hotel, Restaurant, etc.	Manager Service or Recreation
Reading Comprehension	−22	−46	−10
General Information—Navigator	−22	−41	−17
Mathematics	−12	−35	−27
Arithmetic Reasoning	−11	−37	−14
Numerical Operations I	12	3	7
Numerical Operations II	1	−12	−8
Dial and Table Reading	4	−13	−2
Speed of Identification	−10	−6	2
Spatial Orientation I	−1	−18	−6
Spatial Orientation II	−12	−17	−24
Mechanical Principles	−16	−36	1
General Information—Pilot	−12	−25	5
Two-Hand Coordination	4	−4	10
Complex Coordination	−10	10	14
Rotary Pursuit	−4	−1	24
Finger Dexterity	9	21	14
Aiming Stress	−19	−11	−6
Discrimination Reaction Time	−4	−24	8
Biographical Data—Pilot	−10	−26	7
Biographical Data—Navigator	7	12	0
N	522	69	103

charge of buying insurance for a company; the latter of buying insurance for a bank. As indicated, all but a few of the 79 men in this group were branch managers for insurance companies. Average monthly income reported for the group was $719, with a standard deviation of $259. The men had been in the occupation for an average of slightly over 7½ years.

GROUP MEAN SCORE PROFILES

Test score profiles for three groupings of retail managers are shown in Table 15.1, and those for five other commercial occupations in Table 15.2. The rank-difference correlations of these profiles are shown

Table 15.2
Mean Standard Score Profile for Various Business Occupations Concerned with Buying and Selling

	Wholesaler	Buyer	Purchasing Agent	Credit Manager	Manager, Insurance
Reading Comprehension	−22	3	−21	−10	−21
General Information—Navigator	−16	14	−2	−1	−12
Mathematics	−8	−3	1	−1	5
Arithmetic Reasoning	5	−11	−3	−2	11
Numerical Operations I	14	17	21	18	17
Numerical Operations II	23	9	14	23	18
Dial and Table Reading	8	−4	14	13	12
Speed of Identification	−12	−11	9	24	−7
Spatial Orientation I	−3	−14	13	14	15
Spatial Orientation II	5	−16	6	20	−16
Mechanical Principles	−26	−34	−25	−25	−29
General Information—Pilot	−15	4	4	−35	−34
Two-Hand Coordination	−15	−26	−1	−3	−26
Complex Coordination	−33	−15	−2	1	−4
Rotary Pursuit	−6	−9	−7	−16	−3
Finger Dexterity	−5	−9	22	10	1
Aiming Stress	−18	−16	−13	4	−29
Discrimination Reaction Time	−4	7	23	3	21
Biographical Data—Pilot	−12	−24	−29	−33	−25
Biographical Data—Navigator	29	5	1	−5	38
N	85	62	96	46	79

below, with the occupations arranged in an order to bring out the relationships among them.

	2	3	4	5	6	7	8
1. Service or recreation manager	62	53	−14	−03	11	−20	−14
2. Hotel or restaurant manager		74	30	30	41	35	−01
3. Retail store manager			67	64	63	33	22
4. Wholesaler				79	62	45	43
5. Insurance manager					63	46	57
6. Purchasing agent						69	50
7. Credit manager							17
8. Buyer							

It can be seen that one cluster of related profiles is made up of the service and recreation managers, hotel and restaurant managers, and retail store managers. The retail store managers also fit into a second cluster that includes wholesalers, insurance managers, purchasing agents, and (to a somewhat lesser extent), credit managers and buyers.

The condensed profiles, made up of five test score composites, are shown below first for the three retail manager groups and then for the remaining five groups.

	Retail Store Manager	Hotel, Motel, Restaurant Manager	Service and Recreation Manager
General intellectual	−22	−51	−22
Numerical	7	−9	−1
Perceptual-spatial	−10	−18	−12
Mechanical	−10	−29	7
Psychomotor	−9	7	17

The profiles for all three of the retail manager groups were fairly flat, the flattest being that for retail store managers. The store managers do, of course, represent quite a variety of retail establishments. All three groups agreed in that the low point of the profile occurred for the general intellectual composite. In other respects they were somewhat different. The store managers were highest on the numerical tests, whereas the hotel and restaurant managers and the service and recreation managers were highest on the psychomotor composite. Service and recreation managers were also slightly above average on the mechanical tests.

	Wholesaler	Buyer	Purchasing Agent	Credit Manager	Insurance Manager
General intellectual	−13	1	−8	−5	−6
Numerical	18	9	20	22	19
Perceptual-spatial	−4	−18	12	25	−3
Mechanical	−23	−37	−24	−27	−35
Psychomotor	−23	−18	0	0	−13

The five other commercial groups showed generally similar profiles. Although the range of mean standard scores within an occupational group was not very great and the profiles were correspondingly fairly flat, all profiles showed a peak for the numerical tests and a low spot for the mechanical tests. All of these occupations could be spoken of as high numerical, low mechanical occupations. There were a few other features of individual profiles that may merit comment. Wholesalers were somewhat low on the psychomotor tests. Credit managers showed a high point for perceptual-spatial tests. No rationale for these two features comes immediately to mind, but the general pattern of high numerical ability seems reasonable for these commercial jobs.

BIOGRAPHICAL DATA ITEM RESPONSES

Biographical Data Blank item responses for the managers of stores, hotels and restaurants, and service and recreational establishments are shown in Table 15.3. Those for wholesalers, buyers, and insurance managers are shown in Table 15.4. In the case of purchasing agents and credit managers, the number of items that showed differences large enough to be statistically significant was no greater than could have been expected by chance, so that there appeared to be no justification for reporting and trying to interpret these few significant values.

Table 15.3

Significant Biographical Data Item Responses of Retail Store Managers, Hotel and Restaurant Managers, and Managers of Service and Recreation Establishments

	Retail Store	Hotel, Motel, Restaurant, Bar	Service or Recreation
General Family and Personal Background			
Lived mostly in the city	– –		
Many tools in the home	– – –		
Had some college education	+		– –
Father of American stock		– – –	
Family owned expensive car	+ + +		+ + +
Is a good safe driver	+ +		–
Has driven or ridden motorcycle	+		
Family or close friend has been a pilot	+ +		
Major Subject in College			
Did not attend college			+ + +
Social sciences or philosophy		+ +	
Business, commerce, journalism	+ +		
Industrial arts, physical education, agriculture	+		
Biological science, medicine		+	
Physical science, mathematics, engineering	– –	–	– –
School Subjects Studied and Done Well			
Algebra		–	–
Dramatics	+ +		
Economics	+ +	+ +	

Table 15.3 *(Continued)*

	Retail Store	Hotel, Motel, Restaurant, Bar	Service or Recreation
Foreign languages	− − −		
Mechanical drawing	− − −		
Music		+	
Public speaking	+ +		
Shop work			+
Trigonometry	− −	− − −	− − −
Sports Participated in and Done Well			
Boxing, wrestling, water polo		+ + +	+
Auto, motorcycle, motorboat racing	+ +	+	
Horsemanship		+ +	
Activities Done a Number of Times			
Sell article to customer	+ + +		
Write technical report	+		
Arrange club entertainment	+ + +	+ + +	
Interview men for job	+ + +		+ + +
Arrange flower garden	− −		
Solicit for a charity			+ + +
Make a speech	− −		
Adjust carburetor	+		+ + +
Hobbies and Free-Time Activities			
Amusements (dancing, movies)	+ +		
Creative writing			+ + +
Journalism, school paper		+ +	+
Boy Scouts	+ + +		
Woodworking, cabinetmaking			+
Metal work, machine shop	− − −		
Auto repair, rebuilding	+ +	−	+ +
Build nonflying plane models	−		
Build powered model plane	− − −	− −	
Work Experience			
Skilled manual	− −		+
Minor supervisory	+ +		
Engineering, drafting, surveying	−		− −
Sales clerk, canvasser	+ + +		
Sales—auto, real estate, etc.	+ + +		
Managerial	+ + +	+ + +	+ + +
Instructor or leader	+		
Personal service	−	+	
No work experience	+		+ +

Table 15.4

Significant Biographical Data Item Responses of Wholesalers, Buyers, and Insurance Branch Managers

	Wholesaler	Buyer	Insurance Manager
General Family and Personal Background			
Lived mostly in the city		+	+ +
Many books in the home	+	+	+ + +
Had some college education	+ +		+ + +
Father graduated from high school			+ +
Father of American stock		− −	
Mother graduated from high school			+ + +
Mother of American stock		− − −	
Duration of interest in aviation career		− −	
Family owned expensive car	+ + +		+ +
Has driven or ridden motorcycle	+ +		
Major Subject in College			
Did not attend college	−		− − −
Social sciences or philosophy	+ +		+ + +
Business, commerce, journalism	+ + +		+ +
Physical science, mathematics, engineering		−	
School Subjects Studied and Done Well			
Dramatics			+ + +
Economics	+ +		+ + +
English		+ + +	
History		+ + +	
Music			+ +
Physics			− −
Public speaking			+ + +
Shop work			− −
Sports Participated in and Done Well			
Baseball, softball	+ +		+
Tennis, handball, ping-pong, badminton	+		+ +
Sailboating		+ +	
Swimming		+ +	
Track (dashes, hurdles)		− −	
Track (longer races)		− − −	
Activities Done a Number of Times			
Sell article to customer	+		
Arrange club entertainment			+ + +
Interview men for job	+ +		
Arrange flower garden	− −		−

Table 15.4 *(Continued)*

	Wholesaler	Buyer	Insurance Manager
Repair radio set	−	−	
Solicit for a charity		+	+ + +
Make a speech	+		
Adjust carburetor		− −	− − −
Hobbies and Free-Time Activities			
Painting, sketching	− −		−
Music			+ +
Collecting (stamps, etc.)	−		
Dramatics		+	+ + +
Journalism, school paper			+ +
Boy Scouts		+	
Metal work, machine shop			−
Auto repair, rebuilding			− −
Build powered model plane	− −		
Work Experience			
Skilled manual		−	− −
Minor supervisory	+ +		
Simple clerical	+		+ + +
Higher office work	+ + +		+ + +
Sales clerk, canvasser		+ +	
Sales—auto, real estate, etc.	+ + +		
Managerial	+ + +		+ +
Instructor or leader		+ +	+ +
Reporter, lawyer, advertising		+	
Personal service		−	
Reason for Choosing Cadet Training			
Feel have aptitude	+		
Prefer duties to other branches	− −		+ +
Better pay than other branches	+ +	+	
To use training after war	+ +		

The very large group of retail store owners and managers ($N = 529$) showed differences that met the test of statistical significance on many items, though most of these differences were numerically rather small. There were a number of indications of previous sales and managerial background, both in activities reported as engaged in and in paid work experience. The group appeared somewhat low on manual interests and skills, as evidenced by few tools in the home, little participation in metalworking, little background of model plane building, and low participation in skilled manual and engineering types of work. On the other hand, the men reported themselves as good drivers, as having driven or ridden a motorcycle, having participated in auto or boat racing, having adjusted a carburetor, having repaired or rebuilt autos as a hobby.

The group appeared a little low on intellectual and esthetic interests and accomplishments, shown by relatively infrequent attendance at college prior to Air Force service, infrequent majoring in physical science, low accomplishment in trigonometry, foreign languages, and music, little participation in flower garden planning or speech-making, and little employment in engineering types of jobs. The group tended to be a nonurban group, but also showed indications of some prosperity in that the family had frequently owned a good car.

The hotel and restaurant manager group showed only a rather small number of significant differences, and these do not make a very clear pattern. The group had a high proportion of foreign-born fathers. There was a suggestion of higher frequency of college majors in social and biological sciences, and lower in education than for the reference group as a whole. School achievement tended to be low in algebra and trigonometry, and high in economics and music. Above average performance appeared for several individual sports—boxing and wrestling, auto or boat racing, horsemanship. The group had frequently organized club entertainments and participated in writing for a school paper, but infrequently engaged in auto repairing and rebuilding or making flying plane models. They had frequently worked in managerial and personal service occupations.

The service and recreation managers were low on a number of indicators of intellectual and technical competence—college attendance, majoring in physical sciences, achievement in algebra or trigonometry, work in engineering. They were high on certain indicators of manual or mechanical interest and skill—shop work in school, adjusting a carburetor, woodworking, auto repairing, and rebuilding. They were high also on some indicators of managerial interest and interpersonal skill—interviewing men for a job, soliciting contributions for charity, work of a managerial nature, and perhaps creative writing and journalism. Their families had relatively often owned good automobiles.

The wholesalers showed a modest number of significant differences. These pictured a person with a rather practical and business orientation—college major in social science or business, study of economics, experience selling articles, interviewing job applicants and speech-making, emphasis on salary and future usefulness as reasons for entering the Air Force. This person had already often had office, sales, or managerial work experience. He had some talent for sports (baseball, tennis), but tended to be low in esthetic activities (flower gardens, painting) and in those of a mechanical nature (repairing a radio, making flying plane models, preference for flying duties). He tended to come from a home with books and a good car.

The group of store buyers had relatively few significant item responses, and did not show very marked or clear-cut patterns. They tended to be of foreign-born parents, to have lived in the city with books in the home, and to have done well in school in English and history. The picture of nontechnical bias was reinforced by a low proportion of physical science majors and few who had repaired a radio. Above average participation and success in sailing and swimming were balanced by below average performance in track. The group showed work experience in retail selling, in public relations types of work, and in instructing or leading a group. A record of soliciting for a charity and participating in dramatics rounded out a picture of a somewhat verbal and social, but nonmechanical, group.

The managers of insurance offices and branches were significantly different from our total respondent group on quite a large number of biographical items. In general, the items fitted into a consistent pattern rather like that of corporation executives. In the first place, this tended to be a group drawn from relatively well-off urban homes, characterized by many books and well-educated parents. The men themselves had in many cases gone to college prior to entry into the Air Force, where they had tended to major in the areas broadly designated as social sciences and business. In school they showed a high rate of participation and success in economics, but also in dramatics, music, and public speaking. Participation in music and dramatics also showed up in their hobby activities.

These men were low in physics and shop work as school subjects, and in several mechanical and craftsman types of out-of-school activities—i.e., adjusting a carburetor, metalworking, and building and repairing cars. They appeared on the high side on a couple of sports—baseball and tennis—and they participated in group activities in several ways—organizing a club entertainment and soliciting for a charity. The work experience in which they were outstanding was clerical and higher office work, managerial duties, and work as an instructor or group leader.

In general, these were men with good family and educational backgrounds who showed a history of participation and success in activities largely of a verbal and interpersonal nature.

SUMMARY STATEMENT

The eight sales and commercial groups presented in this chapter will be considered one at a time. Two or three sentences will be devoted to presenting the highlights for each in turn.

Retail Store Owner or Manager. This large group showed a flat test profile, but was highest on numerical tests and lowest on the general intellectual measures. Their background showed some evidence of sales and managerial experience. They appeared a little low on intellectual and esthetic interests and accomplishments, and showed a somewhat ambiguous picture as far as manual and mechanical activities were concerned.

Hotel and Restaurant Manager. This group was definitely low on general intellectual tests. Best performance was on psychomotor measures. Biographical items suggested participation in sports and in activities involving interpersonal relations, but a deficit in scholarship and in technical and mechanical activities.

Service and Recreation Manager. This group's rather flat profile was highest on the psychomotor and mechanical composites and lowest on the general intellectual measures. Biographical items indicated participation in some managerial and interpersonal activities, and also in manual and mechanical ones. On indicators of intellectual and technical competence they tended to be somewhat low.

Wholesaler. This group showed, along with the remainder of those considered in this chapter and a number that will be described in the following chapter, a pattern of high numerical and low mechanical scores. The low mechanical was accompanied in this case by low psychomotor performance. The biographical background can be summarized by saying that there were indicators of high interest and participation in business and practical affairs, and low in esthetic and mechanical.

Buyer. The profile for these men showed its peak on the numerical and its hollow on the mechanical composite. General intellectual scores came up to the average of cadet applicants. Biographical items suggested a rather verbal and social, but nonmechanical, group.

Purchasing Agent. The profile pattern of high numerical and low mechanical was repeated for this group. Perceptual-spatial tests were somewhat above average. The biographical item responses of this group did not differ significantly from those of the total group of respondents.

Credit Manager. This was another group characterized by the high numerical, low mechanical pattern. However, for this group the highest point in the profile was on the perceptual-spatial tests. There were few distinctive responses on biographical items.

Insurance Manager. This group also showed a peak on the numerical tests and a low point on the mechanical tests. These men tended to come from well-off urban homes. They had good educational backgrounds, with a strong history of participation and success in activities of a verbal and interpersonal nature, but tended to be low in technical and mechanical areas.

Wholesale Salesman and Other Sales and Commercial Occupations

This chapter continues the presentation of data on sales and commercial occupations. The first groups considered in this chapter are sales managers and a number of groups of wholesale salesmen. These are followed by sales clerks and salesmen of securities, real estate, and insurance. Insurance underwriters and claim adjusters are also covered in this chapter, as are manufacturers' agents and brokers. Each group will be identified and described in the following section.

DEFINITION OF GROUPS

Sales or Promotion Manager. Practically all the men in this group were classified as 0–97.61, Sales Manager. There were one or two cases that were coded 0–97.62, Sales Manager (Dyeing and Cleaning) and 0–97.64, Product Development Manager. The sales managers had general responsibility for sales personnel and sales policies in organizations of various sizes and types, though usually fairly small. There were 261 men in this group, and the average monthly income that they reported was \$707. The standard deviation was \$285. The men had been in sales occupations for an average of 7½ years.

Wholesale Salesman; Clothing and Dry Goods. Our respondents included a large number of wholesale salesmen selling to business and industry. These men differed primarily in the type of commodity that they were selling, and also in the type of agency to which they sold it—i.e., retail store or industrial user. This first group was made up primarily of salesmen of men's and women's clothes, dry goods, and notions (occupations with DOT codes from 1-85.41 to 1-85.46). There were also a few salesmen of sporting goods (1-85.01). The group was composed of 47 men, who reported average monthly earnings of $673. The incomes had the large standard deviation of $382. Average time in the occupation was somewhat under 7½ years.

Wholesale Salesman; Food, Beverages, and Tobacco. More than half of the men in this group were selling foodstuffs (1-85.22). Most of the remainder were selling beverages (1-85.21), but a few were selling tobacco products (1-85.23), and there were a few salesmen of toilet articles (1-85.32). The number of men in the group was 86. Income was reported to average only $480, the lowest for any salesman group, and the standard deviation was $169. Average time in the occupation was somewhat under 7½ years.

Wholesale Salesman; Chemicals and Pharmaceuticals. Almost all the men in this group were salesmen of chemicals and drugs (1-85.31), though there were a few pharmaceutical detail men (1-85.33). The latter category refers to a man who is more a promotional agent for a pharmaceutical house than an actual salesman. The group numbered 52 men. Average income was $574, with a standard deviation of $183. The men had spent an average of somewhat less than 7 years in the occupation.

Wholesale Salesman; Printing, Publications, and Advertising. This group included several sales specialties relating generally to the publications field. Most frequent were salesmen of advertising (1-87.26). There were also a number of salesmen of printing (1-87.23), a few salesmen of publications (1-87.21), and one or two of the other specialties falling within the DOT code group 1-87.2. There were 35 men in the group in all. Average monthly income was $582, but the standard deviation was not available from our computations. Average time in the occupation was slightly under 6½ years.

Salesman of Financial or Transport Services. This was a very small group, numbering only 10. It was made up primarily of salesmen of financial services (1-87.30 and 1-87.31), but also included one or two passenger solicitors (1-87.51). Average monthly income was $591 (no standard deviation available), and the men had spent an average of somewhat over 6 years in the occupation.

Wholesale Salesman of Household Hard Goods. In this group were included men selling a variety of items for the home. The DOT groups covered were 1–85.5, 1–85.6, and 1–85.8. Specific types of products sold in this group were fuel (1–85.51), household equipment (1–85.61), house furnishings (1–85.62), building supplies (1–85.81), and hardware (1–85.82). About half of the group were selling building supplies. The group included 173 men. Mean monthly income was found to be $608, with the large standard deviation of $387. The men had worked in the occupation for an average of almost 7½ years.

Wholesale Salesman of Industrial Hard Goods. This grouping covered a wide range of metals, machinery, equipment, and supplies being sold to industry. The range of DOT codes included was from 1–86.01 through 1–86.47, as well as 1–85.04 and 1–85.11. Some of the specific DOT codes that occurred frequently in this group were 1–85.11, Salesman, Motor Vehicles and Supplies, 1–86.01, Salesman, Metals; 1–86.12, Salesman, Office Machinery; 1–86.28, Salesman, Foundry and Machine Shop Products; 1–86.31, Salesman, Machinery; 1–86.51, Salesman, Paper and Paper Products; 1–86.61, Salesman, Petroleum Products. There were 207 men in the various specific occupational codes within this rather broad grouping of sales jobs. The average of their reported monthly income was $570, and the standard deviation was $215. Time in the occupation was only a little over 6 years.

Sales Clerk, Sales Person, Salesman to Consumers. This group covered all of the DOT 3-digit codes 1–70, Sales Clerk; 1–75, Sales Person; and 1–80, Salesman to Consumers. In general, these were persons who were selling directly to consumers in a retail store. They were selling such things as men's wear, hardware, auto parts, and sporting goods. Average monthly income for the 70 men in the group was $437, with a standard deviation of $204. The men had spent an average of approximately 7 years in the occupation.

Manufacturers' Agent, Salesman, Buyer. This grouping included all of the DOT 3-digit code 1–52, Salesman, Brokerage and Commission Firms N.E.C. In addition, the category 1–61.60, Buyer, was included. However, all except three or four of the men in the group fell in the one DOT code of 1–52.31, Manufacturers' Agent. A manufacturers' agent acts as intermediary between manufacturer and wholesalers, selling products of one or more manufacturers to wholesalers in a given territory. There were 51 of these men in our population, earning an average of $648 a month (standard deviation $259). They had spent an average of somewhat more than 6½ years in the occupation.

Securities Salesman. This grouping corresponded to the DOT 3-digit code 1–65, Stock and Bond Salesman, but practically all of the men fell in the specific code 1–65.03, Securities Salesman. These men were concerned with selling stocks and bonds to individuals or to banks. The group was a small one, numbering only 28. Average reported monthly earnings was $674, with no computations carried out for the standard deviation. The men had spent an average of 6½ years in the occupation.

Real Estate Salesman or Broker. Approximately one-third of the men in this grouping were classified under DOT code 1–63.10, Real Estate Salesman, while the remaining two-thirds were classed as 1–63.20, Real Estate Broker. These appear to be very nearly synonymous jobs, both involving the buying, selling, or renting of real estate for clients on a commission basis. The 79 men in this group reported the relatively high mean income of $770 per month. Their income was also quite variable, having a standard deviation of $365. The men had spent an average of approximately 6½ years in the occupation.

Insurance Salesman. With a few exceptions, the men in this grouping were classified under DOT code 1–57.10, Insurance Salesman. The code includes salesmen of all types of insurance—fire, automobile, and casualty, as well as life insurance. In addition, the group included a few men coded 1–57.20, Special Agent. This is a type of supervisory representative, maintaining contact between the company and local agents and salesmen. There were 169 men in this group of insurance salesmen. Average monthly earnings were $616, but the variability was very large. The standard deviation of $465 indicates that a few of the men in the group were making very substantial amounts. Average time in the occupation was 6½ years.

Insurance Underwriter. There is some question whether this group should have been treated in a chapter devoted primarily to sales personnel. The insurance underwriter is concerned primarily with reviewing and passing on the acceptability of insurance risks. Though the name may be applied to a job involving selling, it ordinarily refers more to the central task of evaluation and review. The group corresponded exactly to the one DOT code 1–57.30, Underwriter. The 27 men in this group reported an average income of $464 per month (no standard deviation computed). Average time in the occupation was only a little over 5½ years.

Insurance Claim Adjustor. This group may also be a little out of place in a chapter devoted primarily to sales personnel. However, the work these men do involves interpersonal negotiation and "selling" of a sort in arriving at a settlement of a claim made under an insurance policy. The DOT code for this occupation is 1–57.50. There were 71 of these men in our population. Average of monthly earnings was $459, with a standard deviation of $152. Average time working in the occupation was somewhat under 6 years.

MEAN TEST SCORE PROFILES

Mean standard scores on each of the tests for sales managers, wholesale salesmen, and retail sales clerks are shown in Table 16.1. Mean standard scores for the insurance, real estate, and other sales groups are shown in Table 16.2.

Examination of the test score profiles indicates that nine of the groups shown in Tables 16.1 and 16.2 had quite similar profiles. An analysis of this similarity was made by correlating the ranking of each of these occupations with a pooled ranking based on all nine of them. Correlations for the separate groups ranged from 0.52 to 0.90. Condensed profiles for these nine groups are shown below, based on five test score composites. In addition to the standard-score composites, the correlation of each group with the pooled ranking (based on all 20 scores) is shown.

		Wholesale Sales							
	Sales Manager	Clothes	Food	Chemical	Publishing, Advertising	Securities Sales	Real Estate Broker	Insurance Sales	Insurance Adjustment
General intellectual	−2	−13	−31	5	−15	15	6	−5	−13
Numerical	10	23	6	22	−1	27	17	8	−5
Perceptual-spatial	−4	0	−20	11	−8	−20	6	14	−9
Mechanical	−14	−51	−31	−29	−43	−50	−7	−17	−44
Psychomotor	−6	−9	−28	2	−17	−32	−9	2	−20
Correlation with pooled rank	0.82	0.90	0.70	0.74	0.72	0.84	0.52	0.62	0.75

The common feature in all these nine profiles is high score on the composite of numerical tests and low score on the mechanical. This same pattern characterized five of the groups considered in the previous chapter. These were wholesalers, buyers, purchasing agents, credit managers, and insurance office managers. Thus, pooling these five occupations with the nine whose profiles are shown, we have 14 sales and commercial occupations showing a common pattern, which we can perhaps think of as a generalized business and commercial pattern. This is a pattern with highest performance on numerical tests and lowest on mechanical tests.

The nine occupations that followed the general pattern described

Table 16.1
Mean Standard Score Profiles of Sales Managers, Wholesale Salesmen, and Sales Clerks

		Wholesale Salesmen			
	Sales Managers	Clothes, Dry Goods	Food, Beverages	Chemicals, Pharmaceutical	Publications and Advertising
Reading Comprehension	-9	-23	-22	3	-11
General Information—Navigator	0	6	-32	17	6
Mathematics	7	-7	-31	1	-18
Arithmetic Reasoning	-4	-15	-12	-7	-22
Numerical Operations I	11	29	16	21	3
Numerical Operations II	11	16	4	3	-7
Dial and Table Reading	2	12	-6	31	1
Speed of Identification	3	7	-6	5	8
Spatial Orientation I	4	12	-6	10	-1
Spatial Orientation II	-17	-18	-35	11	-25
Mechanical Principles	-25	-55	-33	-26	-36
General Information—Pilot	0	-35	-9	4	5
Two-Hand Coordination	-12	-11	-19	0	-50
Complex Coordination	-11	-13	-29	6	-29
Rotary Pursuit	1	-4	-9	4	-7
Finger Dexterity	2	11	-8	3	-1
Aiming Stress	-8	-19	-27	-9	-8
Discrimination Reaction Time	7	-6	-23	22	19
Biographical Data—Pilot	6	-49	-19	-40	-12
Biographical Data—Navigator	23	13	-3	19	5
N	261	47	86	52	35

previously do differ somewhat in detail. Sales managers, real estate brokers, and insurance salesmen showed the flattest test profiles. Food salesmen were relatively low on the general intellectual tests, and securities salesmen relatively high on them. Insurance salesmen differed from the other groups in having their highest peak on the perceptual tests. The groups that received the lowest scores on the mechanical tests were clothing and dry goods salesmen, salesmen of publications and advertising, and securities salesmen—selling jobs where the element of mechanical knowledge bears a relationship neither to the operation of selling nor to the goods sold.

Table 16.1 *(Continued)*

	Wholesale Salesmen			
	Financial and Transportation Service	Household Hard Goods	Industrial Hard Goods	Sales Clerks
Reading Comprehension	−8	−18	−28	−20
General Information—Navigator	5	−8	−27	−25
Mathematics	−13	−19	−31	−41
Arithmetic Reasoning	31	−20	−26	−40
Numerical Operations I	49	−8	−7	−9
Numerical Operations II	43	−5	−9	−25
Dial and Table Reading	−30	−6	−15	−21
Speed of Identification	−62	0	−4	−7
Spatial Orientation I	11	6	5	−18
Spatial Orientation II	−21	4	−22	−38
Mechanical Principles	12	−16	−17	−20
General Information—Pilot	−31	14	−2	−20
Two-Hand Coordination	−20	−20	0	1
Complex Coordination	−12	−13	−12	−2
Rotary Pursuit	−31	−4	3	1
Finger Dexterity	9	−7	−6	−6
Aiming Stress	−11	−16	−5	0
Discrimination Reaction Time	−14	−13	−19	−5
Biographical Data—Pilot	−58	3	5	−32
Biographical Data—Navigator	−52	−1	−1	−23
N	10	173	207	70

The condensed profiles for the remaining six occupations are shown below.

	Wholesale Sales					
	Financial and Transport	Household Hard Goods	Industrial Hard Goods	Sales Clerks	Manufacturers' Agents	Insurance Underwriters
General intellectual	5	−21	−36	−40	−25	3
Numerical	25	−8	−12	−22	−8	2
Perceptual-spatial	−31	4	−9	−28	8	−9
Mechanical	−29	−15	−5	−23	−25	−31
Psychomotor	−20	−15	−8	−3	8	10

Table 16.2

Mean Standard Score Profiles of Manufacturers' Agents, Securities Salesmen, Real Estate Brokers, Insurance Sales, and Adjuster Personnel

	Manufacturers' Agents, Brokers, Buyers	Securities Salesmen	Real Estate Salesmen, Brokers	Insurance Salesmen	Insurance Underwriters	Insurance Claim Adjusters
Reading Comprehension	-26	-12	-9	-15	-10	-17
General Information—Navigator	0	21	-2	-2	-4	4
Mathematics	-22	25	18	6	13	-19
Arithmetic Reasoning	-28	13	13	-3	9	-9
Numerical Operations I	-13	27	12	10	14	-4
Numerical Operations II	-4	39	8	9	-5	-4
Dial and Table Reading	-3	1	23	2	-5	-4
Speed of Identification	-2	-10	-8	-3	-14	10
Spatial Orientation I	16	-5	14	7	20	-15
Spatial Orientation II	5	-30	7	28	-26	-16
Mechanical Principles	-33	-48	-12	-21	-16	-34
General Information—Pilot	-12	-13	11	-7	-4	-33
Two-Hand Coordination	-20	-34	1	-10	-24	-32
Complex Coordination	16	-27	8	-1	22	-20
Rotary Pursuit	2	-25	-11	13	-6	-2
Finger Dexterity	22	-5	-17	6	7	0
Aiming Stress	-19	-29	-5	-14	3	-32
Discrimination Reaction Time	-5	-1	-6	-13	-4	3
Biographical Data—Pilot	-5	-30	-4	-7	-29	-34
Biographical Data—Navigator	13	40	41	11	6	14
N	51	28	79	169	27	71

These groups did not show much correlation with the composite profile from the nine previous groups, or with each other except in isolated instances. Each profile will be commented on briefly.

The salesmen of financial and transport services showed the peak on numerical tests that has been characteristic of commercial occupations. However, they were lowest on the perceptual-spatial composite. In addition, they were rather low on mechanical and psychomotor measures.

Salesmen of household hard goods had a profile that was quite flat. Such peak as it had came on the perceptual-spatial tests and the lowest score was for the general intellectual measures.

Salesmen of industrial hard goods also performed least well on the general intellectual measures, but in their case the best performance was on the mechanical tests. In this respect, they were just the opposite of most sales groups. However, the difference is quite understandable since many of them were selling motor vehicles, machinery, and similar types of equipment.

Sales clerks were another group that was lowest on general intellectual measures. This group was low on all except the psychomotor tests, on which they were about average.

Manufacturers' agents were somewhat low on both general intellectual and mechanical tests. The profile was generally rather a flat one, with perceptual-spatial and psychomotor scores falling slightly above average.

Insurance underwriters were rather low on the mechanical composite, but near average on all of the others.

BIOGRAPHICAL DATA BLANK ITEM RESPONSES

Biographical data item responses are summarized in two tables. Table 16.3 covers the nine occupational groups that showed the common high numerical, low mechanical ability pattern. Table 16.4 covers three other occupations that exhibited fairly distinctive responses on the Biographical Data Blank. Three occupations, insurance underwriters, salesmen of financial and transport services, and salesmen of household hard goods, showed so few significant item responses that further analysis for them did not seem warranted.

The first group shown in Table 16.3 is the group of sales managers. These men differed significantly from our general group of respondents on many biographical items. To begin with, they tended to come from urban homes characterized by many books and relatively well-educated parents. Many of them had gone to college prior to entering the Air Force, where they tended to major in such fields as social science and business and to avoid physical sciences. In school they had done well in such subjects as economics, foreign languages, and history, and participated successfully in dramatics and public speaking. They had also been successful in school in physical education, and reported good success in quite a wide range of sports—football, boxing and wrestling, boating and sailboating, tennis, swimming, and track.

In their out-of-school activities, the sales managers were high on a number of activities of a verbal nature and those involving interaction with others—selling an article, arranging a club entertainment, interviewing men for a job, making a speech, dramatics, creative writing, journalism, Boy Scouts. Work experiences in which the group showed

Table 16.3
Significant Biographical Item Responses for Sales and Commercial Occupations with High Numerical Low Mechanical Aptitude Pattern

	Sales Manager	Wholesale Sales				Securities Sales	Real Estate Broker	Insurance Sales	Insurance Adjuster
		Clothes	Food	Chemicals	Publications Advertising				
General Family and Personal Background									
Lived mostly in the city	+ + +	+ + +	+ + +			+ +			
Many books in the home	+ + +						+ + +	+ + +	
Many tools in the home		− − −		− −		−			
Had some college education	+ + +					+ +	+ + +	+ + +	
Father graduated from high school	+ + +	+ +				+ + +		+ +	
Father of American stock		−							
Mother graduated from high school	+ + +	+ +				+ + +	+	+ +	
Mother of American stock		− −						+	
Parents strongly favored joining Air Force									−
Family owned expensive car							+ + +	+ + +	
Is a good safe driver	+ + +						+ +		
Has driven or ridden motorcycle	+ + +	− −	−						
Family or close friend has been a pilot	+		+ +					+	
Major Subject in College									
Did not attend college	− − −		+ +			− − −	− − −	− − −	
Social sciences or philosophy	+ + +	+ +				+ + +		+ +	+ + +
Education									+
Business, commerce, journalism	+ + +		+	+ + +			+ + +	+ + +	+ +
Biological science, medicine				+					
Physical science, mathematics, engineering	−		− − −						− −

School Subjects Studied and Done Well									
Algebra							+ +		
Dramatics	+ + +		+ +						
Economics	+ + +							+	
English				+ + +	+ + +				+ + +
Foreign languages	+					+ +			
History	+								+ + +
Mechanical drawing		− −	− − −					− −	− −
Music			+	+			+ +	+ +	
Physical training	+ +		+ +					+	
Physics			− − −						
Public speaking	+ + +	+					+	+ + +	
Shop work				− −		− −		− − −	− − −
Trigonometry			− −					+	
Sports Participated in and Done Well									
Football, rugby, soccer	+ + +							+ + +	
Basketball, hockey, lacrosse						− −	+	+ +	
Baseball, softball			+ +	−					
Boxing, wrestling, water polo	+ + +								+
Crew, rowing, canoeing	+ + +	−				+	+	+ +	
Tennis, handball, ping-pong, badminton	+ + +			+			+	+	
Marksmanship		− −							−
Sailboating	+ + +					+ + +		+ +	
Auto, motorcycle, motorboat racing		−							
Swimming	+ + +					+ + +			
Track (dashes, hurdles)	+ + +						+ +		
Track (longer races)	+ +						+ + +		
Activities Done a Number of Times									
Adjust clock			− −					−	
Sell article to customer	+ +		+ +		+				

Table 16.3 (*Continued*)

	Sales Manager	Wholesale Sales: Clothes	Wholesale Sales: Food	Wholesale Sales: Chemicals	Publications Advertising	Securities Sales	Real Estate Broker	Insurance Sales	Insurance Adjuster
Write technical report	+						+ +	+ +	
Arrange club entertainment	+ + +	+ +			+ +		+ + +	+ + +	
Write essay or poem					+ + +		+ +		
Interview men for job	+ + +				+			+ +	
Arrange flower garden									– –
Repair radio set			–						
Solicit for a charity				+				+ +	
Make a speech	+ + +							+ + +	
Adjust carburetor		– – –		–					
Hobbies and Free-Time Activities									
Amusements (dancing, movies)			+ + +	+				+ + +	
Painting, sketching			– –		+ +				
Music								+ +	
Collecting (stamps, etc.)		+ +							
Dramatics	+				+		+	+ +	+
Creative writing	+								+
Journalism, school paper	+ + +				+ + +	+		+ + +	
Boy Scouts	+ + +								–
Photography						–			
Amateur motion pictures	–			+ +				+ + +	
Woodworking, cabinet-making				–		–			– –
Sheet-metal work								– –	
Metalwork, machine shop	–				– –	– – –	– – –	– –	–
Auto repair, rebuilding		– – –	–				– –		
Build nonflying plane models					+ +				

Build powered model plane							− − −		
Participate in model plane contest						−		− −	
Work on glider or plane								− −	
Work Experience									
Skilled manual	− −	− −		−		− −	− −	−	
Minor supervisory							+	+	+ +
Engineering, drafting, surveying			− − −						
Simple clerical	+ +			+ +	+ +		+ +	+	+ + +
Higher office work	+ +						+ + +		
Sales clerk, canvasser	+ + +		+ +		+ +	+ + +		+ +	
Sales—auto, real estate, etc.	+ + +		+ + +		+ + +				
Managerial							+		
Academic			−						
Scientific				+ + +					
Instructor or leader	+ + +		+ +		−		+ + +	+	
Semi-professional				+ +					
Reporter, lawyer, advertising					+ +				
Personal service	+ +		+ + +	+ + +				+	+ + +
Entertainer	+ +				+ + +			+ +	+
Protective service							−	+ +	
No work experience	− −								
Reason for Choosing Cadet Training									
Love of adventure	+				− − −		+		
Best way to serve							+		
Feel have aptitude								+	
Prefer duties to other branches						+			
Better pay than other branches			−			+			
To prove can make good						−			+

high participation included sales, clerical, personal service, entertaining, and group instructor or leader. There was a little indication of low participation in the manual-mechanical areas, though the men reported themselves to be good drivers and to have ridden a motorcycle. All in all, this appeared to have been a well-educated, socially active, sports-minded, and verbal group of young men.

Wholesale clothing salesmen showed relatively few significant differences on the biographical items. They were generally an urban group, with some indication of having parents with better than average education, though tending to be foreign born. They showed low participation in a number of types of mechanical activities and had few tools in their homes. There were also a few indications of low participation in sports. Thus, we could characterize them as a nonmechanical, somewhat person-oriented urban group.

For wholesale food salesmen, the picture of a nonmechanical urban group also held good. They had infrequently ridden a motorcycle, fixed a clock or a radio, or repaired or rebuilt an auto. This group tended also to be low on a number of the technical intellectual activities—physics and trigonometry in school, engineering, and academic work experience. The group was high in previous work experience in selling, and showed some indication of good physical skills.

The group of salesmen of chemicals and pharmaceuticals showed relatively few significant differences on biographical items, and the pattern was far from clear. There was a suggestion of scientific interest and background (college major in biological science, work in science), but also of business interests (college major in business, soliciting for a charity, clerical work). Several indications of low mechanical interest appeared—few tools in home, low on shop work as a school subject, rarely fixed a carburetor or engaged in woodworking as a hobby.

The small group of salesmen of printing, publications, and advertising showed significant differences from the general run of respondents on only a rather small number of items. However, these did appear to fall into a consistent pattern. Most of the items on which this group was high related either to verbal and esthetic activities (English in school, writing an essay or poem, painting or sketching, dramatics, journalism, working as an entertainer) or to interpersonal and sales contacts (selling an article, arranging a club entertainment, interviewing men for a job, working as a salesman or in public relations). The group disavowed adventure as a reason for entering the Air Force.

Securities salesmen were another group, somewhat like sales managers, of urban men with a tendency to have come from homes of above average education and to have gone on to college before entry into the Air

Force. They were low on a number of mechanical items. This group was high on water sports—possibly purely as a matter of place of residence. Their college major tended to be in social science and work experience in selling.

The group of real estate brokers showed a pattern which is becoming quite familiar in these business and commercial occupations. They were high on a number of verbal and social activities—books in the home, public speaking, writing reports, arranging club entertainment, writing essays or poems, engaging in dramatics, minor supervisory work. They were low on a number of mechanical items—metalworking, auto repair or rebuilding, making powered plane models, work in skilled labor. The group tended to be above average in pre-Air Force education and to have well-educated mothers. College major was frequently in business, and work experience was reported in minor supervisory, clerical, higher office, and managerial categories. The family tended to have a good car, and the man often considered himself a good driver.

Insurance salesmen were one more group that tended to be college-educated of well-educated parents. The pattern of majoring in social science or business reappeared in this group. The insurance salesman group gave the impression of being possessed of all the social graces—high in music, physical education, and public speaking in school; participating in a variety of sports, ranging from football to sailboating; organizers of club entertainments, solicitors for charity, and speech-makers; interested in amusements, music, dramatics, and journalism as hobbies. They showed a variety of work experience in clerical, sales, supervisory and managerial categories, and also as group leaders, entertainers, and personal and protective service workers. The one thing that they were *not* was mechanical. Low percentages were obtained for mechanical drawing, shop, fixing a clock, metalworking, auto repair, participation in plane contests, and construction, and skilled manual work.

Insurance adjustors showed rather less of a distinctive pattern. However, many of the general features were similar to ones we have already considered. The group was high on a number of verbal indicators—college major in social science, education, or business, school success in English or history, participation in dramatics or creative writing. It was low on a number of indicators of manual or mechanical interest or skill—college major in physical science, mechanical drawing or shop work in school, woodworking or metalworking as hobbies. Work experience tended to be high in the minor supervisory, simple clerical, personal service, and entertainment fields.

Turning now to Table 16.4, we encounter first the group of manufac-

Table 16.4

Significant Biographical Item Responses for Remaining Sales and Commercial Occupations

	Manufacturers' Agents	Sales Clerks	Wholesale Sales Industrial Hard Goods
General Family and Personal Background			
Lived mostly in the city	+ + +		
Many books in the home	+ + +		
Had some college education	+	−	
Father graduated from high school	+ +	− −	
Father of American stock			+ +
Mother graduated from high school	+ +	−	
Mother of American stock	+ +		+ +
Parents strongly favored joining Air Force		−	+ +
Family owned expensive car			+ + +
Is a good safe driver		− −	
Has driven or ridden motorcycle			+ + +
Major Subject in College			
Did not attend college	− −	+	
Biological science, medicine	+ +		
Physical science, mathematics, engineering		− − −	
School Subjects Studied and Done Well			
English	+ + +		
Music	+		
Physical training	+ +		
Physics			− −
Public speaking	+ + +		
Trigonometry		− − −	−
Sports Participated in and Done Well			
Football, rugby, soccer	+		
Basketball, hockey, lacrosse	+		+ +
Boxing, wrestling, water polo	+		
Crew, rowing, canoeing	+ + +	+ +	+
Diving, ski jumping	+		
Sailboating	+ + +		+
Swimming	+		
Track (dashes, hurdles)	+ + +		
Track (longer races)			− −
Track (field events)	+ + +		+

Table 16.4 *(Continued)*

	Manufac-turers' Agents	Sales Clerks	Wholesale Sales Industrial Hard Goods
Activities Done a Number of Times			
Sell article to customer			+
Arrange club entertainment	+ + +		+
Arrange flower garden			−
Solicit for a charity	+ + +		
Hobbies and Free-Time Activities			
Painting, sketching	+		
Music		+	
Journalism, school paper			− − −
Boy Scouts	+		
Amateur motion pictures		+ + +	
Work Experience			
Engineering, drafting, surveying		− −	− − −
Simple clerical	+ +		
Higher office work	+		
Sales clerk, canvasser		+	+ +
Sales—auto, real estate, etc.			+ + +
Academic			−
Semi-professional			+
Entertainer		+ + +	
Protective service			+ +
Reason for Choosing Cadet Training			
Feel have aptitude	+ +		

turers' agents. These repeat a pattern that has become quite familiar in this chapter. The group was an urban one, from homes with many books and relatively well-educated parents. They tended to have had some college education before entering the Air Force, but were distinctive in that they majored frequently in biological sciences. They were high on a number of indicators of social, esthetic and verbal competence—English, music, and public speaking as school subjects; arranging a club entertainment and soliciting for charity; painting and sketching. They appeared quite strong in sports, being high in physical education in school and in such varied sports as football, basketball, boxing, boating, diving, sailboating, and track (both dashes and field events). Their work experience tended to be in simple clerical and higher office work. On mechanical items they were not significantly different from the total respondent group. Thus, we characterize these men as urban and well-educated, verbal, social, esthetic, and athletic.

The group of sales clerks differed from other sales groups considered in this chapter in being low both on parental education and on pre-Air Force college experience. They were low especially in several scientific and technical items—physics as a college major, trigonometry as a school subject, engineering as work experience. They were high on several possibly related items—music and amateur motion pictures as hobbies, and work as an entertainer. Aside from the above, the sales clerks were a rather undistinguished group.

The last group for which we report the pattern of biographical responses is the group of wholesale salesmen of hard goods to industry. This group tended to be a fairly athletic and out-of-doors (high on motorcycling, basketball, boating, track field events) from native-born stock. The group was high on several sales and promotional activities (selling an article, organizing a club entertainment, working as a sales- man), but tended to be low on verbal and esthetic activities, rather in contrast with other sales groups (low on arranging a flower garden, journalism as a sparetime activity, and academic work). They were also low on technical areas, such as physics and trigonometry as school sub- jects, and engineering as a type of work.

SUMMARY STATEMENT

This chapter has presented data on 15 sales and business occupa- tions, a number of them being variations of selling to trade and in- dustry. The common test pattern, found in nine of these occupations as well as five of those in the previous chapter, is one with the highest score on the numerical tests and lowest on the tests of mechanical abilities. There was also a good deal of similarity in the general pattern of response to the biographical items, with a tendency for the men to be high on verbal and interpersonal items and to be low on those deal- ing with manual or mechanical skills and activities. Each of the occupa- tions will be commented on briefly in the following paragraphs.

Sales Manager. These men showed a very flat test profile, but with the typical sales pattern of high numerical and low mechanical. On biographical items, these men appeared to be from comfortable urban homes, to be well-educated, socially active, sports-minded, and verbal.

Wholesale Clothing Salesman. This group exemplified the sales- commercial ability pattern of high numerical and low mechanical. On biographical items, they tended to be an urban group low on mechanical and to some extent on sports activities.

Wholesale Food Salesman. This group was another which followed the high numerical, low mechanical ability pattern, but in addition this group was rather low on general intellectual and psychomotor tests. Biographical items indicate that this was a group low on both mechanical and technical academic activities.

Salesman of Chemicals or Pharmaceuticals. This was yet another group with the high numerical, low mechanical pattern of scores on the ability tests. On biographical items, there were some indications that scientific and sales interests were both present, and participation in mechanical activities tended to be low.

Salesman of Printing, Publicity, or Advertising. The pattern of high numerical, low mechanical test scores continued to prevail in this group. On the biographical items, this group tended to be high on those relating to interpersonal and sales contacts.

Salesman of Financial or Transport Services. The pattern of high numerical, low mechanical abilities was found again in this group. However, perceptual-spatial and psychomotor scores were also rather low. Biographical items did not differ from the total group of respondents on enough items to permit an interpretation.

Salesman of Household Hard Goods. These men were characterized by quite a flat ability profile, for which the high point was on perceptual-spatial tests and the low on general intellectual measures. Biographical item responses differed significantly from the total group of respondents on too few items to justify interpretation.

Salesman of Industrial Hard Goods. This group differed radically from other salesman groups in that best performance was on the mechanical test composite. Poorest performance was on the general intellectual measures. In biographical background, this group gave the impression of a fairly athletic and out-of-doors group that was low on verbal and esthetic activities. This reaffirms their difference from other sales groups.

Sales Clerk. This group tended to be rather low on all types of tests except psychomotor, and lowest on the general intellectual measures. This was a group from a limited educational background, low especially in scientific and technical fields.

Manufacturers' Agent. A rather flat ability profile showed its low spots in the general intellectual and mechanical areas. On biographical items, this group could be characterized as urban and well-educated, verbal, social, esthetic, and athletic.

Securities Salesman. The common sales pattern of high numerical and low mechanical abilities was repeated in this group. The men tended to come from comfortable urban homes with good educational background. Like other sales groups, they showed a background of sales and promotional experiences, and a tendency to be low on mechanical items.

Real Estate Broker. This group showed a very flat test score profile, distinguished by only a slight peak on numerical and slight hollow on mechanical and psychomotor tests. The biographical item pattern of high percent of response on verbal and interpersonal items and low on mechanical items was repeated for this group.

Insurance Salesman. The men tended to come from well-educated families and to exhibit a wide variety of the social graces. Like most of the groups considered in this chapter, they were low on mechanical items and on the mechanical test composite.

Insurance Underwriter. This group was characterized by near-average performance on all types of tests except the mechanical ones, on which performance was rather low. The biographical items failed to distinguish the group significantly from the total group of respondents.

Insurance Claim Adjustor. This was still one more of the high numerical, low mechanical ability groups. The biographical items did not differentiate this group very markedly, but the general trend was to be high on verbal and social items and low on those of a mechanical nature, a pattern that we have seen repeatedly in this chapter.

CHAPTER 17

Clerical Occupations

The respondents in this study included several hundred men who were engaged in clerical occupations. However, the number of specific occupations represented was very great, and the number of men in any one specific occupation was very small. In order to get samples sufficiently large to give stable results, it was necessary to group occupations fairly broadly. This was done quite subjectively, and the resulting groupings may agree rather poorly with the system at which another set of judges would have arrived. Our grouping recognized five broad categories within the clerical field. These had to do, respectively, with accounting and bookkeeping records, stock and material records, communication and classification records, clerical work involving contact with the public, and clerical machine operating. The groupings are described more fully in the following section.

DEFINITION OF GROUPS

Accounting Record Work. This grouping was set up to take care of those clerical jobs that involve a large amount of working with numbers.

Typical occupations, represented in each case by several men in the group, were: 1–01.02, Bookkeeper II; 1–01.31, Accounting Clerk; 1–05.01, General Office Clerk; 1–06.02, Teller, Banking; 1–18.97, Traffic-rate Clerk; 1–26.02, Payroll Clerk. In all, 30 or more specific DOT codes were represented among the 143 men in this group. Average monthly income was only $396, with a standard deviation of $119. Average time in the occupation was slightly under 6½ years.

Material and Production Record Work. Occupations were included in this group if a major responsibility of the job was keeping track of tangible, physical objects. Again, the number of specific DOT codes was quite large. Illustrations of codes occurring with some frequency were the following: 1–18.66, Production Clerk II; 1–19.01, Airplane Dispatch Clerk; 1–34.02, Expediter I; 1–34.13, Shipping Clerk I; 1–38.01, Stock Clerk; 1–38.51, Storekeeper. Once again, there were 30 or more different specific DOT's represented among the 128 men in the group. These men reported a monthly earned income of $415, on the average, with a standard deviation of $88. They had spent an average of about 6½ years in the occupation.

Communication and Classification Record Work. This group was composed in largest part of postal workers. Major groups were 1–27.10, Mail Sorter, and 1–28.01 Mail Carrier. There was a scattering of other clerical jobs concerned with transmitting messages or handling routine correspondence. Illustrative occupations were 1–18.01, Mail Clerk; 1–16.01, Correspondence Clerk, and 1–41.12, Telegraph Operator. Average monthly earnings for this group were at the low figure of $363, with a standard deviation of $61. The 168 men in the group had spent an average of almost 7½ years in the occupation.

Clerical and Public Contact Work. This grouping was used for clerical jobs that involve a fair amount of direct contact with the public. The job that occurred most frequently in this category was 1–27.20, Post-office Clerk. Other jobs that were encountered a number of times included the following: 1–44.12, Ticket Agent; 1–18.97, Freight-traffic Agent; 1–48.21, Leaseman I (Petroleum); 1–48.23, Right-of-way Agent; and 1–18.35, Investigator II. The 101 men in this group reported an average monthly income of $446, with a standard deviation of $137. Mean time in the occupation was somewhat more than 6 years.

Clerical Machine Operator. This was a small group made up of only 16 men. Most of them worked with electrical data processing machines, and were classed as 1–25.64, Tabulating Machine Operator, or 1–25.67, Machine Records Supervisor. However, there were also a couple of other types of machine operators, such as 1–25.26, Duplicating Machine Operator. Average monthly income for this group was $452 (no standard deviation computed), and time in the occupation averaged 7½ years.

Table 17.1
Mean Standard Score Profiles of Clerical Workers

	Accounting Record Work	Material and Production Record Work	Communication, Classification Record Work	Public Contact Work	Clerical Machine Operators
Reading Comprehension	−22	−33	−28	−1	−38
General Information—Navigator	−13	−26	−34	3	−17
Mathematics	−28	−28	−28	−6	−31
Arithmetic Reasoning	−25	−23	−3	0	−7
Numerical Operations I	−3	0	13	2	−2
Numerical Operations II	4	6	2	8	2
Dial and Table Reading	11	−10	−6	−6	−15
Speed of Identification	0	−7	−14	3	28
Spatial Orientation I	4	−9	−3	−7	−17
Spatial Orientation II	−21	−17	−23	−21	−13
Mechanical Principles	−46	−34	−10	−26	2
General Information—Pilot	−4	−13	−12	1	−34
Two-Hand Coordination	−14	−10	−6	−14	9
Complex Coordination	−3	−10	−11	−15	−13
Rotary Pursuit	−6	19	−6	−9	5
Finger Dexterity	−2	−8	−8	−30	−28
Aiming Stress	−6	−16	−6	−27	−6
Discrimination Reaction Time	−11	−9	−16	−5	−23
Biographical Data—Pilot	−48	−26	−27	−25	−1
Biographical Data—Navigator	−27	−13	−25	−21	−53
N	143	128	168	101	16

GROUP MEAN SCORE PROFILES

The mean standard scores for these groups on the 20 measures of the aircrew battery are shown in Table 17.1. Rank-difference correlations applied to the profiles for the five groups indicate that the first three were rather similar, but that the last two were quite different from these. The correlations are shown below.

	2	3	4	5
1. Accounting	0.77	0.56	0.32	0.12
2. Material		0.61	0.24	0.33
3. Communication			0.07	0.47
4. Public contact				0.02
5. Clerical machines				

Condensed profiles for the five groups, based on pooled composites of related tests, are as follows:

	Accounting	Material	Communication	Public Contact	Clerical Machine
General intellectual	−28	−36	−30	−1	−30
Numerical	5	−2	4	2	−6
Perceptual-spatial	−7	−14	−17	−11	−1
Mechanical	−48	−31	−19	−29	4
Psychomotor	−6	−6	−12	−31	−16

The profiles for the first three groups showed relatively good performance (about equal to the average of all Aviation Cadet applicants) on the numerical tests. With this went low score on both the general intellectual and mechanical composites. The group including bookkeeping and similar jobs was lowest on the mechanical tests, the stock clerk group was about equally low on both intellectual and mechanical, whereas the postmen were lower on intellectual than on mechanical.

By contrast with the previous groups, those classed as jobs involving public contact (ticket agents, postal clerks, etc.) did relatively well on the general intellectual measures. They fell just about at the total cadet mean for both these and the numerical tests. Members of this group were low on both the mechanical and psychomotor composites.

The small group of clerical machine operators showed quite a flat profile, distinguished only by a low score on the general intellectual composite.

BIOGRAPHICAL DATA ITEM RESPONSES

The items on which three of the clerical groups differed significantly from the total respondent group are shown in Table 17.2. Two groups, the public contact occupations and the clerical machine operators, showed too few statistically significant differences to justify any report of them or attempt to interpret them.

The chief impression one gets from the accounting records group, and to a lesser extent the other clerical groups, is a negative one. These groups were characterized chiefly by *not* doing things. The accounting records group tended not to have gone to college and to have been low in percent majoring in industrial arts and physical science. They were low in school achievement not only in academic subjects such as algebra, foreign languages, and trigonometry, but also in mechanical drawing and shop work, as well as in physical training

Table 17.2
Significant Biographical Data Item Responses for Clerical Occupations

	Accounting Records	Material Records	Communication Records
General Family and Personal Background			
Lived mostly in the city			− −
Many books in the home		− −	− − −
Many tools in the home	− − −		−
Had some college education	− − −	− − −	− − −
Father graduated from high school		− −	− − −
Mother graduated from high school		− − −	− − −
Mother of American stock		− −	
Parents strongly favored joining Air Force			
Duration of interest in aviation career		−	
Family owned expensive car	− −	− − −	− − −
Has driven or ridden motorcycle			+
Family or close friend has been a pilot	− −	− −	
Major Subject in College			
Did not attend college	+ + +	+ + +	+ + +
Social sciences or philosophy			− −
Industrial arts, physical education, agriculture	−		
Biological science, medicine		−	
Physical science, mathematics, engineering	− −	−	− −
School Subjects Studied and Done Well			
Algebra	− −	− −	
Dramatics			− −
English			−
Foreign languages	− −		
Mechanical drawing	− −		
Physical training	− − −	−	
Physics	− − −		− − −
Public speaking	− − −		− − −
Shop work	− − −		
Trigonometry	− − −	− − −	− −
Sports Participated in and Done Well			
Football, rugby, soccer	− −		
Boxing, wrestling, water polo	− −		−
Crew, rowing, canoeing	− −		− −
Tennis, handball, ping-pong, badminton		− −	
Marksmanship	− − −		
Sailboating	−		
Auto, motorcycle, motorboat racing	−	−	
Swimming	− −	−	− − −
Track (field events)	− −		
Horsemanship	− − −		

Table 17.2 *(Continued)*

	Accounting Records	Material Records	Communication Records
Activities Done a Number of Times			
Sell article to customer		−	
Write technical report	− − −		− − −
Arrange club entertainment	− −		− − −
Write essay or poem		−	− −
Interview men for job	− −	− −	
Make a speech		− −	− − −
Adjust carburetor	− − −	−	
Hobbies and Free-Time Activities			
Amusements (dancing, movies)			+
Music			− −
Collecting (stamps, etc.)	+		
Dramatics		−	− −
Creative writing			− − −
Journalism, school paper		−	
Boy Scouts			−
Amateur motion pictures	−		
Sheet-metal work	−		
Metalwork, machine shop	− − −		
Auto repair, rebuilding	− −		
Build nonflying plane models		− −	
Build powered model plane		− −	− − −
Participate in model plane contest		− −	
Work Experience			
Skilled manual	− − −	− −	
Minor supervisory	− −		
Engineering, drafting, surveying		− −	
Simple clerical	+ + +	+ + +	+ +
Higher office work	+ + +		
Sales—auto, real estate, etc.	− −	−	
Managerial	−		
Instructor or leader			−
Entertainer			− − −
Social service			+
Reason for Choosing Cadet Training			
Best way to serve	−	−	
Feel have aptitude	− −		
To prove can make good	+ +		

and public speaking. They were also low on a wide variety of sports, including body contact sports such as football and boxing, outdoor sports such as shooting and riding, and "class" sports such as sailboating. They were low on a number of activities that we have taken as indicators of active and somewhat aggressive social participation—arranging a club entertainment, interviewing men for a job, working in supervisory, managerial, or sales occupations. They were also low on a number of manual and mechanical activities—tools in the home, adjusting a carburetor, sheet metal work, metalworking, and skilled manual work. They came from homes that tended not to have a good car, and they were inclined to feel a need to "prove themselves" in the Air Force. About the only positive item in their picture was participation in clerical and office work. In summary, this appeared to be a nonacademic, nonathletic, nonmechanical and nonsocial group when compared with the generality of respondents.

The material records group, including stock and shipping clerks, also presented a predominantly negative picture. However, the negative flavor emphasized somewhat more the verbal and esthetic and somewhat less the mechanical. This group had had limited pre-Air Force education, and came from homes with few books and parents with limited education. The family was unlikely to have owned a good car. The men were unlikely to have had a college major in science or to have done well on algebra or trigonometry in school. They participated infrequently in such sports as tennis, swimming, and auto or boat racing. On a number of verbal and social activities they showed low participation—i.e., in selling something, writing an essay or poem, interviewing men for a job, making a speech, dramatics, journalism, working as a salesman. There were also a few minuses on mechanical items—adjusting a carburetor, making various types of model planes, working in a skilled manual or engineering type of job. However, this group was less negative on these items than the preceding group.

The generally negative picture was continued in the group designated communication records workers who were made up in considerable part of postal workers. This was a group from a somewhat rural background and from homes deficient in books, tools, and a good car. The men tended not to have gone to college and to have had poorly educated parents. They were low especially in social science and physical science majors. In addition to their academic deficiency, this group seemed to be low especially in the verbal and esthetic domain—dramatics and public speaking in school, writing an essay or poem, and making a speech as activities; music, dramatics, and creative writing as hobbies. The group was also low on a few sports and mechanical items, though not to as great an extent as was true for the accounting record group.

SUMMARY STATEMENT

This chapter has presented information on five broad groupings of clerical occupations. The results for each will be summarized briefly below.

Accounting Record Work. These were clerical occupations such as bookkeeper and bank teller that were deemed to involve a substantial component of work with numbers. The ability profile showed highest performance on numerical tests, rather poor performance on general intellectual measures, and very poor performance on mechanical tests. Biographical item responses were significant largely in the negative direction. The group was notably nonacademic, nonathletic, nonmechanical, and nonsocial when compared with the total population of respondents.

Material Record Work. These were clerical occupations concerned with production records and stockkeeping. Average numerical ability was combined with low ability on both general intellectual and mechanical measures. The negative pattern on biographical items was encountered again, but with the deficit appearing more in the verbal and esthetic areas. However, social and mechanical items also showed some tendency to be low.

Communication Record Work. This group was made up in large part of mail sorters and mail carriers. Average numerical test performance was accompanied by rather poor performance on the general intellectual tests. On the biographical items this group appeared to be a somewhat rural group with limited educational background, and to be particularly deficient in items relating to the verbal and esthetic domain.

Public Contact Clerical. This group was made up of such occupations as postal clerk and ticket agent. By contrast with other clerical groups, the men had average scores on the general intellectual measures as well as on the numerical tests. Scores on mechanical and psychomotor tests were rather low. Biographical items did not significantly differentiate this group from the general respondent population.

Clerical Machine Operator. This small group was rather low on general intellectual measures and near the Aviation Cadet average on the other test areas. Biographical Data items did not differentiate them significantly.

CHAPTER 18

Personal and Protective Service Occupations

This chapter presents data on four groups of occupations falling within the general category of personal and protective service. The first group includes police, detectives, and sheriffs; the second group, firemen; the third, guards and watchmen. The last group is a heterogeneous one made up of quite a variety of personal service occupations.

DEFINITION OF GROUPS

Policeman, Detective. This group included those occupations covered in the DOT 3-digit codes 2-65, 2-66, and 2-67. The three codes cover police and detectives in private and in public service, and sheriffs and bailiffs. More than half the men were policemen in public service (2-66.23). Other specific DOT codes that occurred with some frequency were 2-66.01, Police Officer and 2-66.11, Detective. There were also a few classified as 2-67.30, Sheriff. The 119 men in the group reported an average monthly income of $425, with a standard deviation of $116. The men had been working in the occupation for an average of somewhat less than 7½ years.

Table 18.1
Mean Standard Score Profiles of Service Occupations

	Policemen, Detectives, Sheriffs, etc.	Firemen	Guards and Watchmen	Other Personal Service Occupations
Reading Comprehension	−42	−29	−46	−41
General Information—Navigator	−38	−3	−59	−29
Mathematics	−42	−34	−28	−51
Arithmetic Reasoning	−34	−25	−29	−30
Numerical Operations I	−17	−18	10	−32
Numerical Operations II	−22	−24	−15	−31
Dial and Table Reading	−25	−34	−43	−41
Speed of Identification	−5	−8	−44	−13
Spatial Orientation I	−16	2	−37	−15
Spatial Orientation II	−25	−8	−111	−30
Mechanical Principles	−37	−15	−1	−45
General Information—Pilot	−4	2	−7	−25
Two-Hand Coordination	−16	−6	−40	−14
Complex Coordination	−9	3	13	−25
Rotary Pursuit	13	7	4	−26
Finger Dexterity	0	32	12	21
Aiming Stress	−14	−3	−12	−36
Discrimination Reaction Time	−10	−1	−22	−21
Biographical Data—Pilot	−19	−2	−40	−16
Biographical Data—Navigator	−24	−44	−28	−36
N	119	60	12	37

Fireman. Practically all the men in this group fell in the DOT code 2-63.10, Fireman. There were also two or three classified as 2-63.15, Fire Inspector and 2-63.20, Fire Marshall. The 60 men in the group reported an average monthly income of $409, with a standard deviation of only $55. Average time in the occupation was almost 8 years.

Guard, Watchman. The third group was a small one of just twelve guards and watchmen. Representative occupations were 2-61.03, Watchman II, 2-61.21, Institution Guard, and 2-61.70, Guard Sergeant. Average monthly income for this little group was $380 (no standard deviation computed) and average time in the occupation was approximately 6½ years.

Miscellaneous Personal Service. The fourth group was so heterogeneous that data on it are relatively meaningless. However, the results for the group will be presented for whatever interest they may have. The group included a number of men classified as 2–21.10, Bartender and such other categories as 2–22.11, Bellman; 2–26.01, Chef; 2–26.32, Cook; 2–27.02, Waiter; 2–32.01, Barber; 2–32.12, Hairdresser; 2–32.13, Hair Stylist; and 2–42.10, Hospital Orderly. The 37 men distributed among these occupations reported an average monthly income of $554 (no standard deviation computed). Average time for each man in his particular occupation was approximately 6½ years.

TEST STANDARD SCORE MEANS

The mean standard scores for the four groups are shown in Table 18.1. Correlations among the profiles are as follows:

	2	3	4
1. Policemen	0.76	0.53	0.71
2. Firemen		0.40	0.75
3. Guards			0.03
4. Personal service			

Thus the policemen, firemen, and men in personal service occupations showed a good deal of similarity in the tests on which they did relatively well and poorly. Guards showed some resemblance to policemen and firemen, but none to the personal service group.

Condensed score profiles, based on composites of related tests, are shown below.

	Policemen	Firemen	Guards	Personal Service
General intellectual	−50	−29	−52	−49
Numerical	−26	−29	−27	−42
Perceptual-spatial	−20	−6	−83	−25
Mechanical	−32	−10	−36	−33
Psychomotor	−4	15	6	−29

All of the profiles were fairly flat, except for the small group of guards. Policemen, firemen, and guards agreed in having their highest scores on the psychomotor tests. All groups were relatively poor on the general intellectual composite. The guards were quite low on the perceptual-spatial tests. The general level of test performance was definitely below the total Aviation Cadet applicant average for all of these groups. They were individuals of rather modest talents, as far as talents are indicated by our tests, excepting in the psychomotor area.

Table 18.2

Significant Biographical Data Responses for Policemen and Firemen

	Policemen	Firemen
General Family and Personal Background		
Lived mostly in the city		+ + +
Many books in the home	− −	− −
Many tools in the home		+
Had some college education	− − −	− − −
Father graduated from high school	− − −	− − −
Father of American stock		− − −
Mother graduated from high school	− − −	− − −
Mother of American stock		−
Parents strongly favored joining Air Force		+ +
Duration of interest in aviation career		+ +
Family owned expensive car	−	
Major Subject in College		
Did not attend college	+ + +	+ + +
Business, commerce, journalism	− −	
Physical science, mathematics, engineering	− − −	
School Subjects Studied and Done Well		
Algebra	− − −	−
Foreign languages		− −
Physical training	+ + +	
Physics	− − −	
Public speaking		−
Shop work		+ + +
Trigonometry	− − −	− − −
Sports Participated in and Done Well		
Football, rugby, soccer	+ + +	+
Baseball, softball	+	
Boxing, wrestling, water polo	+	
Crew, rowing, canoeing	+	
Auto, motorcycle, motorboat racing		+ +
Activities Done a Number of Times		
Sell article to customer		− −
Write technical report	− −	− −
Solicit for a charity	−	
Make a speech		−

Table 18.2 *(Continued)*

	Policemen	Firemen
Hobbies and Free-Time Activities		
Dramatics		– –
Journalism, school paper		–
Photography	–	
Metalwork, machine shop	+ +	+
Work Experience		
Skilled manual		+ +
Academic		–
Entertainer		–
Protective service	+ + +	
Reason for Choosing Cadet Training		
Love of adventure	+	– – –
To prove can make good	+	+

BIOGRAPHICAL DATA ITEM RESPONSES

Items on which the policemen and firemen differed significantly from the total group of respondents are summarized in Table 18.2. There were too few significant differences for the groups of guards and of personal service workers to justify any analysis.

The police group was characterized by limited education both for the men and their parents, and by few books in the home. College majors in which the group was particularly low were business and physical science. These men reported a low rate of successful participation in quantitative types of school subjects—algebra, physics, and trigonometry. They were high only in physical training, and this was accompanied by high participation in football, and to a lesser extent baseball, boxing, and boating. The men in the group already had in a number of cases some work experience in protective service. They indicated liking for adventure and a desire to prove that they could make good as reasons for volunteering for Aviation Cadet training.

Firemen came generally from an urban background. Like the policemen, they tended to have little education and to come from families of little education, where the parents were of foreign background. They had considered an Air Force career for some time, and their parents were inclined to favor their joining the Air Force. Relatively poor school performance in such subjects as foreign languages, algebra, and trigonometry was accompanied by low performance in public speaking. There were a number of other evidences of limited verbal and social talents, since the group fell below the total group of respondents on selling an article, writing a technical report, making a speech, in dramatics, and working as an entertainer. The group showed some indication of manual skill, since the men were high on shop work in school, auto or boat racing as a sport, metalworking as a hobby, and work experience in skilled manual occupations.

SUMMARY STATEMENT

This chapter presents data on four groups of protective and personal service occupations. Major characteristics of each group are summarized in the following paragraphs.

Policeman or Detective. These men were about average on the psychomotor tests, but below average on all others and especially low on the general intellectual measures. They were a group of limited academic background and success, especially in quantitative work. However, they tended to have done relatively well in sports and physical activities.

Fireman. Men in this group were best on psychomotor tests and poorest on general intellectual and numerical measures. They tended to have come from an urban background of limited education and to have shown poor performance on academic subjects. Indications of some deficit in verbal and social areas were accompanied by some signs of manual interest and skill.

Guard or Watchman. This small group, was low on all except the psychomotor tests. No significant pattern of biographical item responses could be identified.

Personal Service, Miscellaneous. A quite heterogeneous assortment of personal service occupations was combined in one group. These men showed a flat profile of test scores well below the Aviation Cadet average. No distinctive pattern of biographical item responses could be identified for this rather small and quite varied group.

CHAPTER 19

Agricultural Occupations

This chapter covers occupations in agriculture. The total number of our respondents working in this broad segment of our national economy was only 308, so analyses were necessarily based on rather broad groupings. We separated out three groups for analysis, consisting of general farmers, specialized farmers, and a miscellany of other workers in agriculture.

DEFINITION OF GROUPS

General Farmer. The majority of the farmers in our group could only be classed as general farmers. These were, in the words of the DOT, "farmers engaged in the raising and harvesting of crops and the raising and breeding of livestock and poultry on a farm devoted to diversified agriculture." The DOT code is 3-06.10. Also included in this group were a number classified as 3-37.10, Farm Manager. We had 168 men in the group, who reported an average monthly earned income of $362. The standard deviation was $148. The men had spent an average of slightly more than 8 years in the occupation.

Specialized Farmer. This group included those farmers whose activities were clearly of a specialized nature. The most frequent specialties were 3-01.10, Grain Farmer; 3-04.10, Dairy Farmer; 3-05.01, Fruit Farmer; 3-07.10, Livestock Farmer; and 3-08.10, Poultry Farmer. Other specialties were represented in small numbers. The total number in all these different specialized forms of farming was 112. Average income was $546, but with the large standard deviation of $389. There were a few operators of large ranches in this group whose incomes far surpassed those of the rest of the group. Average time in the occupation was about 7½ years.

Other Agricultural Specialties. This group included a number of occupations related to the growing of plants or animals. The occupations covered the DOT code groups 3-38, Nursery Operators and Flower Growers; 3-40, Gardeners and Grounds Keepers; and 3-41, Hatchery Men. The most numerous occupation in the group was 3-38.20, Nurserymen, but many different specific occupations were represented by one or two men. The group included only 28 men. Average monthly income was $454 (no standard deviation computed), and average length of time in the occupation was almost 7½ years.

TEST STANDARD SCORE MEANS

The mean standard scores for each of the three groups on each of the 20 variables of the aircrew test battery are shown in Table 19.1. Records for the miscellaneous group of agricultural workers were incomplete, and certain of the means are missing. The patterns for the two groups of farmers were rather similar, and the rank-difference correlation was 0.60, but that for the miscellaneous group was quite different from the other two. These patterns can be seen more clearly in the consolidated standard score profiles based on related groups of tests shown below.

	General Farmer	Specialized Farmer	Other Agricultural
General intellectual	−6	−29	13
Numerical	−7	−32	10
Perceptual-spatial	−29	−21	−1
Mechanical	38	24	−16
Psychomotor	−36	−35	18

Both groups of farmers were clearly above average on the mechanical test composite. General farmers appeared as a group to be quite competent mechanics, and to be close to the total Aviation Cadet average on measures of general intellectual ability and of numerical skill. They showed below average performance on the perceptual-spatial and the

Table 19.1

Mean Standard Score Profiles for Agricultural Occupations

	General Farmer	Specialized Farmer	Other Agricultural
Reading Comprehension	0	-11	*
General Information—Navigator	-26	-29	8
Mathematics	-13	-23	20
Arithmetic Reasoning	20	-26	12
Numerical Operations I	-15	-30	1
Numerical Operations II	7	-27	17
Dial and Table Reading	-10	-23	*
Speed of Identification	-35	-23	-5
Spatial Orientation I	-25	-23	3
Spatial Orientation II	-7	-3	*
Mechanical Principles	51	26	*
General Information—Pilot	21	1	-16
Two-Hand Coordination	36	16	-11
Complex Coordination	-13	-25	32
Rotary Pursuit	-14	-8	23
Finger Dexterity	-30	-16	19
Aiming Stress	-38	-44	-25
Discrimination Reaction Time	-9	-23	18
Biographical Data—Pilot	-1	12	-13
Biographical Data—Navigator	-47	-27	-19
N	168	112	28

* **Information missing.**

psychomotor measures. The specialized farmer group was generally low on all except the mechanical tests. It is interesting that the more prosperous specialized farmers show a somewhat less distinguished test profile than the general farmers.

The miscellaneous group of agricultural workers, by sharp contrast with the farmers, was lowest on the mechanical composite. This group was slightly above average on general intellectual and numerical abilities and also on the psychomotor measures. There is perhaps more resemblance to biological and agricultural scientists in this group than to farmers.

BIOGRAPHICAL DATA ITEM RESPONSES

Significant item responses for the two groups of farmers are summarized in Table 19.2. The small group of miscellaneous agricultural

Table 19.2
Significant Biographical Item Responses for Farmers

	General Farmer	Specialized Farmer
General Family and Personal Background		
Lived mostly in the city	− − −	− − −
Many books in the home	− − −	
Many tools in the home	+ + +	
Father of American stock	+ +	+ + +
Mother graduated from high school		− −
Mother of American stock	+ + +	+ +
Parents strongly favored joining Air Force		− − −
Duration of interest in aviation career	−	
Family owned expensive car	+ +	+ +
Has driven or ridden motorcycle	+ + +	+ + +
Major Subject in College		
Social sciences or philosophy	− − −	
Business, commerce, journalism	−	
Industrial arts, physical education, agriculture	+ + +	+ + +
Biological science, medicine	− −	−
School Subjects Studied and Done Well		
Dramatics	−	
Economics		−
English	− − −	− −
Foreign languages	− − −	−
History	− − −	
Mechanical drawing	− − −	− − −
Music	− −	
Public speaking	− − −	
Trigonometry	− − −	− −
Sports Participated in and Done Well		
Football, rugby, soccer	− − −	
Crew, rowing, canoeing	− − −	
Tennis, handball, ping-pong, badminton	− − −	−
Diving, ski jumping	− −	
Marksmanship		+ + +
Sailboating	− − −	
Swimming	− − −	
Horsemanship	+ + +	+ + +

Table 19.2 *(Continued)*

	General Farmer	Specialized Farmer
Activities Done a Number of Times		
Adjust clock	+	
Sell article to customer	− − −	− −
Write technical report	− − −	
Arrange club entertainment	−	
Write essay or poem	− −	− −
Adjust carburetor	+ + +	+ + +
Hobbies and Free-Time Activities		
Amusements (dancing, movies)	−	− − −
Painting, sketching	− −	
Music	− −	
Collecting (stamps, etc.)	− − −	− −
Dramatics	− −	
Creative writing	− − −	− −
Journalism, school paper	− − −	
Boy Scouts		−
Woodworking, cabinetmaking	+ + +	
Auto repair, rebuilding	+ + +	
Build nonflying plane models	− − −	− − −
Build powered model plane	− − −	− − −
Participate in model plane contest	− − −	
Work Experience		
Unskilled manual	+ +	
Skilled manual	−	
Minor supervisory	+ + +	+ + +
Engineering, drafting, surveying	−	
Simple clerical	− − −	− − −
Higher office work	− −	
Sales clerk, canvasser	− − −	− − −
Academic	− − −	
Instructor or leader	−	
Personal service	− − −	− −
Entertainer	− − −	
Protective service		+
No work experience	+ + +	+
Reason for Choosing Cadet Training		
Love of adventure	− −	
To use training after war		− −

occupations yielded too few percentages significantly different from those of the total respondent group to justify reporting and interpreting them.

The general farmers tended, naturally, to be a rural group, and one gets the impression that the great majority of them had grown up on farms. Their homes had contained few books, but many tools, and there were numerous indications that the men had worked with these tools. Thus, they reported frequently having adjusted a clock or a carburetor, done woodworking, and repaired or rebuilt autos. However, they had seldom made model planes. Thus, one senses that their mechanical activities had had a practical and utilitarian slant. Their lives appear to have had relatively little of the arts and the social graces—little dramatics, music, or public speaking in school; little painting, music, collecting, writing, or journalism as hobbies. They were low on a number of sports, but many of these probably represent lack of any opportunity to participate—i.e., rowing, diving, sailing, swimming, and possibly football. Participation and success in the more academic school subjects were low—such subjects as English, foreign languages, history, and trigonometry. There was also a dearth of work experience in anything other than farming. The general picture was one of a limited experience background, strong only in those mechanical and outdoor activities that would be readily available on a farm.

The general pattern on biographical items was much the same for the specialized farmers, though it was perhaps less clear-cut than for the general farmer group. They showed high percentages on having ridden a motorcycle or a horse, hunted, or repaired a carburetor. They were low on a range of academic, social, free time, and work experiences.

SUMMARY

In this chapter data have been presented on agricultural workers. Three groups have been analyzed separately: general farmers, specialized farmers, and a group of varied agricultural specialties. A paragraph will be devoted to each.

General Farmer. These men were definitely high on tests falling in the mechanical composite. They were about average, for our population, on general intellectual and numerical tests, but below average on perceptual-spatial and psychomotor measures. Biographical items showed high participation in practical mechanical activities and a deficit in most other types of experiences—social, verbal, esthetic and perhaps athletic.

Specialized Farmer. This group fell quite definitely above average on the mechanical tests, but were below average, and about equally so, on all the others. The same general pattern of biographical items characterized them as appeared for the general farmers, though it was somewhat less clear-cut.

Other Agricultural Specialties. These men showed a flat near-average profile having no resemblance to the farmer groups. The mechanical composite was lowest for them, rather than highest. For this small group, no distinctive pattern of biographical item responses emerged.

CHAPTER 20

Machinists and Handicraftsmen

This chapter reports data on eight groups of skilled workmen, working with machine tools and in handicrafts. Unfortunately, the numbers in some of the groups are quite small and others include a wider range of specific jobs than would be ideal, so that results are somewhat undependable. The groups are described in the following section.

DEFINITION OF GROUPS

Machinist. This group included machinists and tool and die makers. The grouping covered most of the jobs covered in the DOT code groups 4–75, Machinist, and 4–76, Tool Maker and Die Sinker and Setter. About half of the men were classified as 4–75.01, Machinist. Other codes that occurred fairly frequently were 4–76.16, Job Setter (responsible for setting up machine tools), 4–76.01, Die Maker; and 4–76.21, Tool Maker. The group numbered 106. The average of reported monthly incomes was $467, with a standard deviation of $121. Average time in the occupation was approximately 8 years.

Machine Shop Specialist. These men were primarily operators, trained to operate one specific machine tool. Some of them fell under DOT group 4–78, Machine Shop and Related Occupations N.E.C., and some fell under the code group 5–84, Tool Sharpener and Dresser. A number of different specific DOT codes were represented, in each case by a small number of individuals. Typical examples were 4–78.011, Engine Lathe Operator; 4–78.031, Milling Machine Operator; 4–78.044, Boring Mill Operator; 4–78.133, Gear Milling Machine Operator; 4–78.511, Cylindrical Grinder Operator; 5–84.11, Tool-Grinder Operator; and 5–84.12, Tool-Grinder II. There were 65 men in the group. Average monthly income was reported as $426, with a standard deviation of $100. The men had spent an average of slightly less than 7 years in the occupation.

Printing Craftsman. This group included men in the various specialties that work on the preparation of material for printing. Four DOT code groups were grouped together here: 4–44, Compositor and Typesetter; 4–45, Electrotyper and Stereotyper; 4–46, Lithographer; and 4–47, Photoengraver. The most frequently occurring code was 4–44.01, Compositor. Other occupations found in the group included 4–44.11, Linotype Operator; 4–45.01, Electrotyper; 4–45.21, Stereotyper; and 4–46.20, Photolithographer. The 47 men in the group reported an average monthly income of $507, with a standard deviation of $205. Average time in the occupation was over 8½ years.

Printing Pressman. As indicated by the heading, these were the men who actually ran printing presses. The DOT code group was 4–48, and the two specific occupations chiefly represented were 4–48.01, Cylinder-Pressman and 4–48.05, Offset Pressman. The group was a very small one, made up of only 13 men. Average monthly income was reported to be $467 (no standard deviation reported) and the men had worked in the occupation for over 9 years, on the average.

Handicraftsman, Machines or Instruments. Two DOT codes were separated out from the remainder of the machinist group for separate analysis. These were 4–75.12, Bench Machinist, and 4–75.13, Instrument Maker II. The bench machinist "performs various duties involved in fitting and assembling machines, equipment, and subassemblies, using hand tools and machine tools, such as scrapers, drill presses and arbor presses. . ." There were only 11 men in this grouping. Average monthly income was reported as $445 (no standard deviation computed). The men had worked in the occupation for somewhat over 7 years.

Jeweler or Watchmaker. Most of the men in this little group of 17 were classified as 4–71.510, Watchmaker, and were presumably largely

Table 20.1
Mean Standard Score Profiles of Machinists and Handicraftsmen

	General Machinists	Machine Shop Specialists	Printing Craftsmen	Printing Pressmen
Reading Comprehension	−29	−30	−42	−36
General Information—Navigator	−29	−33	−40	−101
Mathematics	−32	−51	−45	−26
Arithmetic Reasoning	−19	−32	−43	2
Numerical Operations I	−2	−29	−3	−31
Numerical Operations II	1	−31	−32	−22
Dial and Table Reading	−15	−51	−28	−24
Speed of Identification	−7	−3	−8	−14
Spatial Orientation I	19	−16	−3	−10
Spatial Orientation II	−2	−22	−30	−9
Mechanical Principles	12	−11	−56	−13
General Information—Pilot	4	2	−21	−37
Two-Hand Coordination	45	8	−17	64
Complex Coordination	36	−16	−17	26
Rotary Pursuit	8	−7	−5	72
Finger Dexterity	32	−20	6	5
Aiming Stress	10	−11	−35	−29
Discrimination Reaction Time	2	−52	−22	−16
Biographical Data—Pilot	12	−4	−34	13
Biographical Data—Navigator	−41	−27	−49	−15
N	106	65	47	13

engaged in watch repair. There were also a few men in such occupations as 4-71.010, Jeweler; and 4-72.315, Ring Maker. The average monthly income for the group was only $373 (no standard deviation computed), and average time in the occupation was slightly over 7 years.

Cabinetmaker, Pattern Maker, or Model Maker. About half of the men in this group were classed as 4-32.100, Cabinetmaker, and most of the remainder as makers of some type of wooden patterns or molds. These were jobs falling in the code grouping 5-17, Pattern and Model Maker. All of the jobs grouped together here were thought to involve precise and skillful woodworking. The 27 men in this group reported an average monthly income of $469, with a standard deviation of $100. The men had been working in the occupation for an average of somewhat over 7½ years.

Handicraftsman, Other. This group included a wide variety of specific occupations which appeared to have as their common feature

Table 20.1 *(Continued)*

	Handicraftsmen			
	Machines and Instruments	Jewelry and Watches	Cabinet-making	Other
Reading Comprehension	26	13	−20	−34
General Information—Navigator	−32	−11	−28	−33
Mathematics	−31	2	−28	−33
Arithmetic Reasoning	−1	15	−16	−38
Numerical Operations I	−36	−1	−39	1
Numerical Operations II	−62	−15	−18	−18
Dial and Table Reading	−51	6	−14	−39
Speed of Identification	−16	−11	6	6
Spatial Orientation I	−19	18	−21	−16
Spatial Orientation II	−47	27	14	−28
Mechanical Principles	−4	17	25	−26
General Information—Pilot	5	−11	14	−12
Two-Hand Coordination	36	37	33	−21
Complex Coordination	3	11	20	−11
Rotary Pursuit	14	−2	20	8
Finger Dexterity	−17	32	−10	−21
Aiming Stress	−44	−29	−28	−1
Discrimination Reaction Time	−79	36	−14	−17
Biographical Data—Pilot	−44	5	22	−5
Biographical Data—Navigator	−35	−4	−30	−30
N	11	17	27	43

fairly skilled handwork on materials of one kind or another. Some of the occupations that were represented in the group were 5-08.010, Optician; 4-68.200, Stonecutter; 4-21.010, Furrier; 4-35.610, Auto Upholsterer; 4-60.100, Shoe Repairman; 4-57.112, Tire Builder; 4-65.420, Glass Bender; 4-81.010, Bench Molder; and 4-81.050, Machine Molder. The group was obviously a rather heterogeneous one from the field of skilled labor. There were 43 men in it. Their average monthly income was reported as $431, with a standard deviation of $133. Average time spent in the occupation was somewhat under 8 years.

MEAN TEST STANDARD SCORES

The mean standard scores on each variable of the aircrew test battery for each of the occupations are shown in Table 20.1. The score profiles for the eight groups were all somewhat similar. This is seen from the fact that each correlates appreciably with a pooled ranking based on all eight groups combined. Highest correlation with this pooled ranking (0.84) is obtained for the machinists, with the machine operators (0.74) and the cabinetmakers (0.73) following. Lowest correlations are for the two small groups of craftsmen.

Condensed test profiles, based on composites of similar tests, are shown below. The correlation of each group with the composite of all groups is also shown in this tabulation.

					Handicraftsmen			
	Machinist	Machine Shop Specialist	Printing Craftsman	Printing Pressman	Machines and Instruments	Jewelry, Watches	Cabinet-making	Other
General intellectual	−35	−47	−55	−52	−12	6	−30	−45
Numerical	−6	−45	−25	−31	−60	−4	−29	−22
Perceptual-spatial	4	−18	−18	−14	−36	15	0	−17
Mechanical	31	−3	−47	28	−5	26	35	−23
Psychomotor	32	−20	−19	28	−17	5	1	−9
Correlation with composite	0.84	0.74	0.64	0.77	0.49	0.44	0.73	0.59

In general, though with some variations, these groups tended to do well on mechanical and psychomotor tests and poorly on general intellectual measures. This was the pattern for the machinists. The machine shop specialists were about at the Aviation Cadet average for the mechanical composite, but quite low on general intellectual and numerical measures. The printing craftsmen were below average on all test areas, but especially so on mechanical and intellectual tests. They came up to the Aviation Cadet average only on a test of finger dexterity. The small group of printing press operators was above average on mechanical and psychomotor measures, but low on numerical tests and quite low on the general intellectual measures. The little group of machine and instrument makers was highest on the mechanical tests and quite low on the numerical tests. Jewelers and watchmakers showed a flat profile of average or better than average scores, but with a slight peak for the mechanical tests. The cabinetmakers were quite high on the mechanical tests but rather low on both intellectual and numerical tests. The miscellany of other craftsmen showed a rather flat profile, but were somewhat lower on the intellectual than on the other tests.

BIOGRAPHICAL DATA BLANK ITEM RESPONSES

Because of the small numbers involved, several of the groups considered in this chapter failed to yield very clear patterns in their biographical backgrounds. For the jewelers and watchmakers, the number of significant responses was too few to justify reporting them. The information for the other occupational groups is given in Table 20.2.

The clearest pattern was the one that emerged for the group of approximately 100 machinists. These men tended to be of foreign

Table 20.2
Significant Biographical Data Responses of Machinists and Handicraftsmen

	Machinist	Machine Shop Specialist	Printing Crafts	Printing Pressman	Handicraftsmen		
					Machines	Woodworking	Others
General Family and Personal Background							
Lived mostly in the city		− − −		+ +			
Many books in the home	− − −		−				
Many tools in the home	+ +						
Had some college education	− − −	− − −	− − −	− − −	− − −	− −	− − −
Father graduated from high school	− − −	− − −					− −
Father of American stock	− − −	− −	− − −		−	+	
Mother graduated from high school	− − −	− − −		− −	− −	−	− − −
Mother of American stock	− − −	−	− −	− −			
Parents strongly favored joining Air Force			+ +				+ +
Duration of interest in aviation career						+	
Is a good safe driver		−	−				
Has driven or ridden motorcycle		+ + +					
Family or close friend has been a pilot		−		− −	− −		
Major Subject in College							
Did not attend college	+ + +	+ + +	+ + +	+ +	+ + +	+ + +	+ +
Social sciences or philosophy	− −		−				
Business, commerce, journalism	−						
Biological science, medicine	−						
Physical science, mathematics, engineering	− −	− − −	− −		−	− −	

Table 20.2 *(Continued)*

	Machinist	Machine Shop Specialist	Printing Crafts	Printing Pressman	Handicraftsmen		
					Machines	Woodworking	Others
School Subjects Studied and Done Well							
Algebra		— — —					
Dramatics	— — —						
Economics		—		—	— —		
English	— — —						
Foreign languages	—				—		
History			— —			—	—
Mechanical drawing	+ + +					+	
Music	— —						
Physical training					—	—	
Physics			— —				
Public speaking	— — —				—		
Shop work	+ + +	+	+ +	+ +		+ + +	
Trigonometry	— —	— — —	— — —				— —
Sports Participated in and Done Well							
Football, rugby, soccer						—	
Baseball, softball				+ +	—		
Boxing, wrestling, water polo						—	
Tennis, handball, ping-pong, badminton					—		
Diving, ski jumping		+ +		+ +			
Auto, motorcycle, motorboat racing						+ + +	
Track (dashes, hurdles)						—	
Horsemanship			— — —				
Activities Done a Number of Times							
Adjust clock	+						
Sell article to customer			— — —		— —		
Write technical report	— — —		— —	— —	— — —		
Arrange club entertainment	— —	— —			— —		
Write essay or poem	— — —			— —	—		
Interview man for job	— — —						+
Make a speech	— — —	—		— — —	— —	— —	
Adjust carburetor	+ + +				+		+
Hobbies and Free Time Activities							
Amusements (dancing, movies)	—						
Painting, sketching							+ +
Music	—						

Table 20.2 *(Continued)*

	Machinist	Machine Shop Specialist	Printing Crafts	Printing Pressman	Handicraftsmen		
					Machines	Woodworking	Others
Collecting (stamps, etc.)		− −					
Dramatics	− − −						
Creative writing	− −						
Journalism, school paper	− − −	− − −					− −
Boy Scouts	− − −						− − −
Amateur motion pictures				+ +	+ +		
Woodworking, cabinetmaking						+ + +	
Sheet-metal work	+ + +					+	
Metalwork, machine shop	+ + +	+ + +					+ + +
Auto repair, rebuilding	+	+					
Build powered model plane	+ +					+ +	
Participate in model plane contest							+ +
Work Experience							
Unskilled manual	−		− −				
Skilled manual	+ + +	+ + +	+				+
Minor supervisory	−						
Engineering, drafting, surveying		−	−				
Simple clerical	− − −	− −	− − −	− −	− −		−
Higher office work	− − −						
Sales clerk, canvasser			− −				
Academic	− −	−	−				
Instructor or leader	− −		−				
Reporter, lawyer, advertising	− −						
Personal service			−				
Protective service	+ +					+ + +	
No work experience				+ +			
Reason for Choosing Cadet Training							
Love of adventure				− −	−		
To use training after war							+ +
To prove can make good			+ +			− − −	+ + +

parentage, and to have come from homes with a number of tools, but few books. Their parents had received limited amounts of education, and relatively few of the men had received any college education before entering the Air Force. Consequently, they showed small percentages for all college majors, but especially for social and physical sciences. They reported low participation or success in a variety of verbal, esthetic, and interpersonal activities, both as school subjects and as work or free-time activities. Thus, in school they were low on dramatics, English, foreign languages, music, public speaking, and trigonometry; general activities and hobbies on which they fell low included writing a technical report, arranging a club entertainment, writing a poem or essay, interviewing a man for a job, making a speech, music, dramatics, creative writing, and journalism. By contrast, they reported a high level of participation in a number of mechanical activities, including mechanical drawing and shop work in school, repairing a clock, adjusting a carburetor, sheet metal work and work in a machine shop as free-time activities and employment in skilled trades. They appeared to be a mechanical, nonverbal type of group.

The pattern for machine shop specialists was rather similar to that for machinists, but rather less clear and full, possibly because of the smaller size of the group. One additional feature was that this tended to be a nonurban group, and certain other responses such as experience with motorcycles and a general shortage of hobby experiences may be related to this fact. The group as a whole tended to be one of limited education, limited accomplishment in academic and verbal lines, and high participation in manual and mechanical activities.

The 47 men employed in various printing crafts did not show a very full or clear pattern of biographical item responses differentiating them from the total respondent group. They were fairly clearly a group who had not gone to college, and they tended to come from foreign-born parents and homes with limited resources of books. Their prewar work experience was inclined to be in skilled trades, and they showed low percentages participating in work classified as unskilled, engineering, clerical, sales, or instructional. There were quite a few in the group who had participated in none of the listed hobby and free-time activities. A number of them viewed their life as cadets as an opportunity to prove themselves.

For the small group of printing pressmen, the biographical picture was quite meager. These were an urban group of limited education. The mother was likely to have a low educational level and be foreign-born. The men were high in participation in a couple of sports, but low in several verbal and social activities. Many of them had had no prewar work experience. The total picture is far from clear because of the small size of the group.

The eleven bench machinists and instrument repairmen also yielded a rather meager picture, but one generally consistent with the picture for machinists that we have presented previously. They were a group of limited education, with indications of having parents of limited education and a foreign background. They were low in a number of verbal and interpersonal activities, whether in or out of school.

The same general pattern repeated itself in the small group of woodworking craftsmen, though with minor variations. This appeared to be more of a native-born group, and their prewar experience appeared related to their present occupation. Thus employment had been primarily in skilled trades, and they reported frequently having participated in woodworking. Other plus points were mechanical drawing and shop work in school; auto, motorcycle or motorboat racing; and making flying plane models. The group was low on several sports and on speech-making.

Finally, there was the group of miscellaneous craftsmen of various types. These yielded a rather meager and somewhat unclear biographical picture. Education was again low, both for the man and for his family. Frequency of participation in skilled trades prior to entry into the Air Force tended to be high, and there were some other indications of mechanical interest and competence. Academic, verbal, and esthetic activities appeared low in spots, but the picture was not sharply defined.

SUMMARY STATEMENT

In this chapter we have presented information on eight groups of craftsmen and skilled workmen. All groups had somewhat similar test profiles, though the resemblances were not close for certain of the groups. Small numbers of cases make the evidence on some of the groups rather meager, so that the picture must be considered quite tentative in these cases. Each group is commented on briefly in the following paragraphs.

Machinist or Tool and Die Maker. These men were well above average in the mechanical and psychomotor composites and below average only on the general intellectual composite. Their biographical picture was one of high mechanical participation and interest, but of low participation in verbal, esthetic, and some interpersonal activities.

Machine Shop Specialist. The men in this group were lower than fully qualified machinists on all composites, but showed somewhat the same pattern. Best performance was on the mechanical composite, with poorest on the general intellectual and the numerical tests. The biographical item pattern was again one of high participation in manual and mechanical activities and low in academic and verbal achievement.

Printing Craftsman. This group showed a rather flat below-average test profile that was somewhat unusual in that both the general intellectual and the mechanical composites were quite low. In terms of biographical responses, it appeared to be a group of rather limited family and educational background and of limited participation in many of the activities treated in the blank.

Printing Pressman. These men showed an ability pattern rather similar to that of the machinists, being high on mechanical and psychomotor tests and low on those contributing to the general intellectual composite. The group was small, and thus the pattern of biographical item responses was rather unclear.

Bench Machinist or Instrument Repairman. The group numbered only eleven, and so results are not very meaningful. The men were best (about average) on the mechanical composite and quite low on the numerical tests. Insofar as it could be discerned in so small a group, the biographical pattern was generally similar to that for machinists.

Jeweler or Watchmaker. The ability profile for this small group was flat and near or slightly above average. The two composites on which the group did best were mechanical and perceptual-spatial. Significant biographical data responses were too few to justify reporting.

Cabinetmaker or Woodworker. This was another group that tended to be high on mechanical and low on numerical and general intellectual measures. Biographical background items indicated strength in manual and mechanical activities and a deficit in education and in several sports.

Handicraftsman, Other. The last group was composed of miscellaneous craftsmen from a wide range of occupations. Their test scores were generally below average—least so on the psychomotor composite and most on the general intellectual measures. Biographical items indicated a meager educational and cultural background, with some suggestions of mechanical interest and competence, but the picture was far from clear-cut.

CHAPTER 21

Mechanics

This chapter reports data for six groups of mechanics, classified according to the type of equipment that they were called upon to repair or maintain. The first group worked on automobile and airplane engines, the second on factory machinery and production equipment, the third on aircraft and automobiles, except for the engines, and on some general factory maintenance and repair, the fourth on cameras and household equipment, the fifth on office machines, and the sixth on kilns, boilers, and steam power plants. The groups are more fully described below.

DEFINITION OF GROUPS

Engine Mechanic. This was a group made up primarily of 5-81.010, Automobile Mechanic; and 5-80.100, Airplane Mechanic, though a number of similar and related DOT codes also occurred in the group. Ones that were found several times in the group included 5-80.130, Aircraft Engine Mechanic, 5-80.910, Airplane Inspector; 5-97.110, Foreman, Auto Service; and 5-83.935, Test Engine Mechanic. The common element running through these jobs is the responsibility for maintenance, diagnosis, and repair of internal combustion engines and the related equipment. Our population contained 98 men in these various mechanical specialties, who reported an average monthly income of $439, with a standard deviation of $156. They had spent an average of somewhat over 7 years in the occupation.

Mechanic, Industrial Machinery. The second group of mechanics worked primarily in factories, setting up and maintaining machines and production equipment. The two DOT's that accounted for the bulk of this group were 5–78.100, Millwright and 5–83.641, Maintenance Mechanic II. A millwright "changes the lay-out and set-up of machines and mechanical equipment in a plant or mill wherein the machinery is usually of the heavy type, and keeps the machines and equipment in efficient operating condition." The maintenance mechanic "keeps machinery and mechanical equipment of an establishment in a state of good repair. . . . In general, works with lighter machinery than a millwright." The group also included a scattering of other DOT codes, such as 5–83.941, Refrigeration Mechanic; 5–83.644, Wind Tunnel Maintenance Man; and 7–83.326, Machine Adjuster. The group numbered 53 in all. Average monthly income was $439, with a standard deviation of $105. The men had spent an average of approximately 7½ years in the occupation.

Mechanic, Vehicles or Factory Equipment. The third group of mechanics was one that worked on vehicles, except for the engines, or that provided general mechanical service around a factory or mill. This grouping should perhaps be thought of as a somewhat less specialized, or possibly more versatile mechanic group. It was made up primarily of three DOT codes. The first was 5–80.120, Aircraft Mechanic, who is described as doing maintenance on parts of the aircraft other than the engine. The second was 5–81.510, Auto Body Repairman. The third was 5–83.621, Maintenance Man, Factory or Mill, who is described as a general fixer and handyman. The group was composed of 41 men, who reported an average monthly income of $456, with a standard deviation of $117. They had spent an average of not quite 7 years in the occupation.

Mechanic, Household Equipment. This small group was made up of various types of mechanics who work with home equipment. Included were 5–83.040, Gas Appliance Serviceman; 5–83.461, Gas Meter Repairman; 4–94.512 Refrigerator Tester; and 5–83.023, Furnace Installer and Repairman. The group numbered only 16. Their mean reported monthly income was $408 (no standard deviation available) and they had spent an average of somewhat less than 7½ years in the occupation.

Table 21.1
Mean Standard Score Profiles of Various Groups of Mechanics

	Engines	Machines and Production Equipment	Vehicular and Structural Equipment	Appliances and Cameras	Office Machines	Kilns, Boilers, Engines
Reading Comprehension	−8	−28	−23	8	56	−30
General Information—Navigator	−21	−42	−116	−14	38	−23
Mathematics	−34	−52	−50	−51	35	−13
Arithmetic Reasoning	−25	−33	−32	−3	23	−40
Numerical Operations I	−23	−22	−56	6	−8	−10
Numerical Operations II	−22	−31	−63	8	15	3
Dial and Table Reading	−23	−38	−43	8	−5	−4
Speed of Identification	−20	−15	5	1	38	23
Spatial Orientation I	−31	−19	5	2	13	1
Spatial Orientation II	−15	−37	−26	37	26	−2
Mechanical Principles	17	10	−2	46	53	4
General Information—Pilot	10	−9	13	27	69	12
Two-Hand Coordination	14	22	28	33	−7	11
Complex Coordination	−30	21	−25	51	38	44
Rotary Pursuit	−9	2	3	24	19	19
Finger Dexterity	−15	−1	7	38	18	18
Aiming Stress	−12	−24	0	29	21	−17
Discrimination Reaction Time	−20	−9	−57	19	−22	12
Biographical Data—Pilot	33	15	17	−7	33	−18
Biographical Data—Navigator	−35	−57	−63	−23	−44	−62
N	98	53	41	16	18	22

Mechanic, Office Machines. These men repaired and serviced typewriters, calculators, and other office machines. Specific DOT codes included 5-83.111, Office Machine Serviceman; 5-83.126, Statistical Machine Serviceman; and 5-83.127, Typewriter Serviceman. The group numbered only 18. Mean monthly income was $424 (no standard deviation available), and the men had spent an average of somewhat over 6 years in the occupation.

Stationary Engineer and Related. This grouping was made up of men whose responsibility was to keep a kiln, steam engine, power plant, or similar installation operating. One specific DOT code represented was 5-72.010, Stationary Engineer, who "operates and maintains stationary engines and mechanical equipment such as steam engines, air compressors, generators, motors, turbines, ventilating and refrigerating equipment, steam boilers and boiler-feed-water pumps." A similar job, also included, was 5-72.020, Maintenance Engineer. Other DOT codes represented in this group were 6-66.611 Fireman, Kiln; 6-67.350, Blower Operator; 5-23.910 Operating Engineer; 5-72.915, Rotary Rig Engineman; 5-72.920; Gas Compressor Operator; 7-70.040, Fireman, Stationary Boiler; and 7-71.010, Oiler II. The group was made up of only 22 men. They reported an average monthly income of $430 (no standard deviation available) and had been in their occupation for approximately 7 years, on the average.

MEAN STANDARD SCORE PROFILES

The mean standard scores on each of the tests of the aircrew selection battery for these six occupational groups are shown in Table 21.1. All of the groups except the office machine repairmen had rather similar profiles. The individual profiles had rank-difference correlations of from 0.70 to 0.90 with a composite ranking based on all five. However, the office machine repairmen showed a correlation of only 0.26 with this composite. It may be noted that the composite for the groups considered in this chapter correlated 0.83 with the composite developed in Chapter 20 for machinists and handicraftsmen.

The main features of the ability profiles are brought out in the following table, in which the separate test scores are organized into five composite scores.

	Engine Mechanic	Factory Mechanic	Vehicle Mechanic	Appliance Mechanic	Office Mechanic	Stationary Engineer
General intellectual	-28	-50	-72	-19	49	-34
Numerical	-27	-37	-65	9	1	-4
Perceptual-spatial	-29	-31	-7	17	33	10
Mechanical	28	21	19	32	35	-1
Psychomotor	-25	-1	-6	54	36	24

Except for the office machine repairmen, who were highest on the general intellectual measures and high on all except the numerical composite, the general pattern was one of relatively good performance on mechanical and psychomotor tests and poor on the intellectual measures. The engine mechanics were above average on the mechanical composite, and below average by almost identically the same amount on all the other composites. The group of millwrights and maintenance mechanics did best on the mechanical composite and next best on the psychomotor tests. The general intellectual measures represented the poorest performance for this group. The airplane and auto body repairmen and general factory handymen were also above average on the mechanical tests, but were decidedly low on the general intellectual and numerical measures. The household equipment mechanics performed outstandingly well on the psychomotor tests, and also were above average in mechanical performance. The remainder of the tests fell near the Aviation Cadet average. Stationary engineers were somewhat superior in psychomotor performance and somewhat below average on the general intellectual measures, falling close to the cadet average on the other tests.

BIOGRAPHICAL ITEM RESPONSES

In part because of the small size of the groups, there were only three of the groups of mechanics that yielded a large enough number of Biographical Data item responses differing significantly from the general population values to merit reporting and discussion. These are shown in Table 21.2.

The general pattern had a good deal in common for all three groups. All tended to come from parents with a limited amount of education, and not to have gone to college themselves before entering the Air Force. All showed a deficiency specifically of physical science majors in college and of trigonometry pursued successfully in school. All were high on shop work as a school subject, skilled trades as a field of prewar work, and such activities as fixing a carburetor, doing metalwork, and auto rebuilding and repair. These elements appear repeatedly in the craftsman and skilled trades jobs of this and other chapters.

Some supplementing of the general pattern is possible for each of the job groups. The group of auto and aircraft engine mechanics appeared to be a nonurban group. The men were low on quite a range of verbal and interpersonal activities, both in and out of school—i.e., dramatics, economics, foreign languages, history, music, and public speaking as school subjects; writing a report, making a speech, dramatics, and creative writing as activities. As a corollary to this, their homes tended to have few books. The picture of mechanical activity included high proportions engaging in auto or boat racing, woodworking, sheet metal work, model plane contests, and construction of a plane or glider. There were quite a few who had had no prewar work experience, and also quite a few who had engaged in auto sales.

Table 21.2

Significant Biographical Data Item Responses for Selected Groups of Mechanics

	Engines	Industrial Machinery	Vehicles
General Family and Personal Background			
Lived mostly in the city	– – –		
Many books in the home	– – –		– –
Many tools in the home		+ +	
Had some college education	– – –	– – –	– – –
Father graduated from high school	–	– – –	–
Mother graduated from high school	–	– – –	– – –
Duration of interest in aviation career			+ +
Is a good safe driver			– – –
Has driven or ridden motorcycle	+		
Major Subject in College			
Did not attend college	+ + +	+ + +	+ + +
Social sciences or philosophy	– –		
Industrial arts, physical education, agriculture	+		
Physical science, mathematics, engineering	– –	–	–
School Subjects Studied and Done Well			
Dramatics	–	– –	
Economics	– – –		
English		– –	– –
Foreign languages	– –		
History	– – –		– –
Music	–		
Physics		–	
Public speaking	– – –	– –	
Shop work	+ + +	+ +	+ +
Trigonometry	– – –	–	– –
Sports Participated In and Done Well			
Basketball, hockey, lacrosse			– – –
Tennis, handball, ping-pong, badminton		– – –	
Marksmanship	+ + +	+	
Auto, motorcyle, motorboat racing	+ + +	+ +	
Activities Done a Number of Times			
Adjust clock		+	
Arrange club entertainment	– – –	–	
Write essay or poem	–	– –	
Interview men for job		– –	
Repair radio set			+
Make a speech	– – –		– – –
Adjust carburetor	+ + +	+ + +	+ + +

Table 21.2 *(Continued)*

	Engines	Industrial Machinery	Vehicles
Hobbies and Free-Time Activities			
Amusements (dancing, movies)		–	– –
Painting, sketching		–	
Music	– –		
Collecting (stamps, etc.)	– –	– –	–
Dramatics	–	– –	
Creative writing	– – –	–	
Journalism, school paper		– –	– –
Woodworking, cabinetmaking	+ +		
Sheet-metal work	+ + +	+ + +	
Metal work, machine shop	+ +	+ + +	+ + +
Auto repair, rebuilding	+ + +	+ + +	+ + +
Participate in model plane contest	+ +		+
Work on glider or plane	+ + +		+ + +
Work Experience			
Semi-skilled manual	+ + +		– – –
Skilled manual	+ + +	+ + +	+ + +
Engineering, drafting, surveying		– –	
Simple clerical		– –	– –
Higher office work	–		–
Sales clerk, canvasser	– –	– – –	
Sales—auto, real estate, etc.	+ + +		+
Reporter, lawyer, advertising		–	
Protective service	+ +		
No work experience	+ +		+
Reason for Choosing Cadet Training			
Prefer duties to other branches		– –	–
To prove can make good	–		+ + +

The millwrights and maintenance mechanics came from homes well equipped with tools. They also were low on a number of the verbal and verbal-social items, though the specific items differed slightly from those appearing for the previous group. (It must be remembered, however, that the difference is often between just reaching and just not reaching the threshold for significance.) This group was low on work experience in a number of types of occupations that tend to be verbal or interpersonal in nature—i.e., clerical, sales, and public relations.

The group of airframe and auto body workers and general industrial maintenance men was not a very well-defined group. Beyond the general skilled-trades syndrome described at the beginning of the section, there was not a great deal to note. It is perhaps worth reporting that a relatively large percentage of them had been considering aviation as a career for some time, and a relatively large number mentioned "proving that I can make good" as a reason for entering cadet training. This group showed a high percentage of those with no prewar work experience and also with some experience in auto sales. A scattering of low percentages on verbal and academic items also appeared.

SUMMARY STATEMENT

This chapter has presented data on six groups of mechanics, differentiated with respect to the type of mechanical equipment that they were called upon to repair or maintain. The ability profiles for all six groups were quite similar, and collectively they showed a pattern similar to that of the craftsmen considered in the preceding chapter. The evidence on each group is summarized briefly in the following paragraphs.

Engine Mechanic. These men were somewhat above average on the composite of mechanical measures, and about the same distance below average on all the other composites. The biographical pattern for this group was quite clearly one of low academic, low verbal and interpersonal, and high mechanical background, a pattern that characterized many of the skilled trades groups.

Millwright or Maintenance Mechanic. This group was quite high on the mechanical composite, average on psychomotor performance, and low on the remaining scores—especially the general intellectual tests. The general pattern of high mechanical, low verbal was repeated on the biographical items for this group.

Vehicle Mechanic. This group of auto body men and aviation mechanics working on systems other than engines was above average on the mechanical composite and very low on the numerical and general intellectual tests. On the biographical items they showed, though somewhat less clearly, the mechanic-craftsman syndrome that we have noted for several other groups in these chapters.

Household Equipment Mechanic. This small group was a relatively able group, performing particularly well on the psychomotor tests and falling above average also on the mechanical and perceptual-spatial composite. They were too few to yield any clear pattern of biographical item responses.

Mechanic on Office Machines. This was also a small and relatively able group. The men differed from most mechanic groups in doing very well on the general intellectual measures. They were also above average in psychomotor, mechanical, and perceptual-spatial scores. Results from the biographical items were not sufficiently clear-cut to justify reporting.

Stationary Engineer and Related Occupations. These men were somewhat above average on the psychomotor composite and somewhat below on the general intellectual tests. No report of biographical item responses seemed justified.

CHAPTER 22

Electricity and Electronics

This chapter presents information on six groups of occupations concerned with electricity or electronics. The first group was made up primarily of electricians. The second included makers and repairmen of electrical instruments and equipment. The third grouping covered workers in electrical power plants and power distribution systems. The fourth and fifth groups were made up of telephone workers—installers and linesmen, respectively. The last group was composed of radio and television repairmen. More detailed information about the groups is given in the following paragraphs.

DEFINITION OF GROUPS

Electrician or Electrical Repairman. The members of this group fell in large part under two DOT codes. About two-thirds of the group were coded 4–97.010, Electrician, responsible for installing the electrical wiring, fixtures, and equipment in buildings. The other third were coded 4–97.420, Electrical Repairman, responsible for keeping wiring and electrical equipment such as electric motors in good repair. There were 88 men in the group. Average reported monthly income was $462, with a standard deviation of $131. The men had spent an average of 7½ years in the occupation.

Equipment and Instrument Installer or Repairman. This grouping included a number of specific DOT codes. The common theme was that all were involved in the making or repairing of electrical instruments or equipment, usually instruments involving some degree of precision. Codes that occurred with some frequency were 5-00.912, Instrument Maker; 5-83.041, Electrical Appliance Serviceman; 5-83.921, Elevator Repairman; 5-83.972, Aircraft Instrument Man; 5-83.975, Electrical Instrument Repairman; and 5-92.601, Foreman, Electrical Equipment. The group included 84 men. Average monthly income was reported to be $436, with a standard deviation of $88. Average time in the occupation was approximately 7 years.

Utilities Electrician. Most of the men in this group fell either among the group of occupations classed under the 3-digit code group 5-51, Power Station Operator, or under the code 5-95.320, Foreman (light, heat and power). The group was a small one, made up of only 20 men. Average monthly income was $478 (no standard deviation available), and average time in the occupation a little over 8 years.

Telephone Installer. About 90% of the men in this group fell in the range of DOT codes from 5-53.010 through 5-53.374. This group of DOT's includes a variety of specific types of installers and repairmen of telephone equipment. Specific codes that occurred with some frequency included 5-53.010, Central Office Installer; 5-53.030, Station Installer; 5-53.210, Combination Man (i.e., installer and maintenance man); 5-53.235, Central Office Repairman; 5-53.236, Switchman II; and 5-53.240 Private-Branch-Exchange Repairman. The group also included a few foremen (5-95.320) and inspectors (5-76.210). For the 82 men in the group average monthly income was $449. The standard deviation was quite small, only $63. Average time in the occupation was almost 8½ years.

Linesman. This group included linesmen for both telephone and power companies. DOT's fell between 5-53.410 and 5-53.965. Representative specific occupations included 5-53.410, Linesman, Senior; 5-53.420, Linesman, Power; 5-53.920, Transmission Engineer; and 5-53.950, Cable Splicer. There were only 23 men in the group. They reported an average monthly income of $430 (no standard deviation available) and had spent an average of somewhat under 8 years in the occupation.

Radio or Television Repairman. The men covered by this grouping fell in most cases either under DOT code 5-83.411, Radio Repairman,

Table 22.1
Mean Standard Score Profiles for Various Groups of Workers with Electricity and Electronics

	Structural Wiring	Instruments, Equipment	Power Systems	Telephone Installers	Linesmen, Cablemen	Radio, Television
Reading Comprehension	−1	−12	−28	−6	−47	−17
General Information—Navigator	−23	−29	−32	−14	−52	−19
Mathematics	−27	−33	−18	−23	−47	−33
Arithmetic Reasoning	−24	−27	−14	−15	−43	−32
Numerical Operations I	−13	−33	−18	−20	−67	−23
Numerical Operations II	−14	−41	−34	−17	−7	−45
Dial and Table Reading	−24	−32	−51	−13	−30	−23
Speed of Identification	−7	−5	−19	8	−16	8
Spatial Orientation I	−26	−30	−52	1	−28	14
Spatial Orientation II	−29	7	−5	2	−33	27
Mechanical Principles	28	10	28	7	8	−6
General Information—Pilot	13	0	27	−1	−9	−2
Two-Hand Coordination	21	12	6	4	−6	19
Complex Coordination	0	10	−17	9	−12	31
Rotary Pursuit	−11	11	−1	2	21	4
Finger Dexterity	8	4	19	−9	−2	−3
Aiming Stress	−6	−7	−15	−7	−64	−19
Discrimination Reaction Time	−5	−23	−39	−11	14	8
Biographical Data—Pilot	29	17	16	1	1	−8
Biographical Data—Navigator	−43	−33	−51	−34	−49	−26
N	88	84	20	82	23	33

or 5-83.477, Radio Mechanic. The difference in these appears to be that the mechanic may be concerned with transmitters and commercial equipment, as well as home receivers. At the time the DOT was published, there were no jobs in television, so no separate codes covering this were available. Many of our men were concerned with television sets at least as much as with radios, but all were recorded under the same code. The group included 33 men. Average monthly income was $461, with a standard deviation of $115. The men had spent a little over 7 years in the occupation, on the average.

TEST SCORE PROFILES

The mean standard scores for each of the groups on each of the 20 variables of the aircrew test battery are shown in Table 22.1. The six profiles in this table all had a good deal of basic similarity. Ranking the tests in order from highest to lowest score for each occupation, and then preparing a pooled ranking for all six groups, we found that correlations of the individual rankings with the pooled ranking ranged from 0.71 to 0.96. The pooled ranking for these occupations has been correlated with the pooled rankings for craftsmen and mechanics with the following results.

Electrical workers vs. craftsmen (Chapter 20)	0.82
Electrical workers vs. mechanics (Chapter 21)	0.93

The correlation of craftsmen and mechanics has previously been reported as 0.83. Thus, it is obvious that the pattern of strengths and weaknesses was much the same for the occupations represented in all three of these chapters.

Condensed profiles for each group, based on five composites of related tests, are shown below.

	Structural Wiring	Instruments Equipment	Power Systems	Telephone Installers	Linesmen Cablemen	Repair—Radio TV
General intellectual	-24	-33	-30	-19	-61	-33
Numerical	-20	-43	-41	-20	-42	-37
Perceptual-spatial	-27	-12	-33	5	-33	27
Mechanical	35	17	22	5	1	2
Psychomotor	-3	1	-5	-2	-22	5

The general pattern for these groups is to be somewhat above average on the mechanical score composite, about average on the psychomotor tests, and below average on the other three composites. The most noteworthy exception is in the case of the radio and TV repair and maintenance group. These men were best on the perceptual-spatial measures. One may hazard a guess that this was a reflection of the role of diagrams and schematics in that type of work. Telephone installers were also at least average on the perceptual-spatial tests, and the spatial complexity both of the equipment and of diagrams of it can be argued as a factor in this case. The linesmen and cablemen seemed somewhat less able than the remaining groups.

BIOGRAPHICAL DATA ITEM RESPONSES

Two of the groups, in part at least because of the small number of cases, failed to yield enough item responses on the Biographical Data Blank differing significantly from the general respondent population to justify reporting and interpreting them. The significant responses for the remaining four groups are shown in Table 22.2.

The group of electricians showed a pattern of item responses similar in many respects to those that we have seen for groups of craftsmen and mechanics. This was a pattern of high participation in mechanical and low in verbal and academic activities. The low academic and verbal showed up on such items as level of pre-Air Force education; majoring in social science and physical science; school participation and success in dramatics, economics, English, foreign languages and public speaking; making a speech, dramatics, creative writing and journalism as free-time activities. It is worth noting, however, that this group reported school participation and success not only in shop and mechanical drawing, but also in physics. They had engaged frequently not only in auto repair and woodworking, but also in repairing a radio. Thus, there was a suggestion of technical know-how as well as mechanical achievement. The men tended to come from homes of native stock, with abundant tools but few books. They frequently expressed concern with proving they could make good as a reason for seeking cadet training, and infrequently mentioned preference for the duties of the job or interest in the higher salaries.

The equipment and instrument installers and repairmen repeated much the same pattern of biographical responses as the electricians. This group showed a limited amount of education both for the men and their parents. Low academic performance appeared in a number of subjects of the college preparatory type, and above average percentages were limited to shop work and mechanical drawing. Participation was infrequent in most types of work other than skilled trades, and many of the men had had no work experience of any kind prior to entering the Air Force. The group was high in repairing a radio and in several other manual and mechanical items.

The pattern of limited educational background and limited participation in a number of verbal-social activities appeared once again in the group of telephone installers. This was a somewhat urban group, but with tools in the home and experience in making a flower garden. Work experience tended to have been in skilled trades, with low percentages in several other categories. This group was another expressing a frequent concern with "proving" themselves.

The general pattern that has been described for the three previous groups appeared again with only minor variations for the radio and TV repairmen. Limited education, experience fixing radios, low participation in some verbal and interpersonal activities, work experience primarily in skilled trades characterized this group also.

Table 22.2

Significant Biographical Data Item Responses for Men Employed in Electricity and Electronics

	Structural Wiring	Instruments, Equipment	Telephone Installers	Radio, TV Repair
General Family and Personal Background				
Lived mostly in the city			+ +	
Many books in the home	– – –			– –
Many tools in the home	+ +	+ +	+	
Had some college education	– – –	– – –	– – –	– – –
Father graduated from high school	–	– – –	– –	–
Father of American stock	+			
Mother graduated from high school		– – –	– –	– –
Mother of American stock	+ +			
Duration of interest in aviation career		+ +		
Family owned expensive car		–		
Family or close friend has been a pilot			– –	
Major Subject in College				
Did not attend college	+ + +	+ + +	+ + +	+ + +
Social sciences or philosophy	– – –	– –		–
Physical science, mathematics, engineering	– –	– –	– –	
School Subjects Studied and Done Well				
Algebra			– – –	
Dramatics	–	– –	– –	–
Economics	– –	– – –		
English	– – –			
Foreign languages	– – –	– – –	– – –	
History		– –		
Mechanical drawing	+ + +	+ +		+
Physics	+ + +			
Public speaking	– – –			–
Shop work	+ + +	+ +	+ + +	+
Trigonometry		– –	–	
Sports Participated in and Done Well				
Basketball, hockey, lacrosse		–	–	
Boxing, wrestling, water polo		+		
Marksmanship	+ + +	+ +		
Auto, motorcycle, motorboat racing			–	
Track (dashes, hurdles)				+ +
Track (longer races)	– – –		–	+ +

Table 22.2 *(Continued)*

	Structural Wiring	Instruments, Equipment	Telephone Installers	Radio, TV Repair
Activities Done a Number of Times				
Arrange club entertainment		− −	− −	− −
Write essay or poem			− −	− −
Interview men for job	−			
Arrange flower garden		+ +	+ + +	
Repair radio set	+ + +	+ + +		+ + +
Make a speech	− − −		− −	− − −
Adjust carburetor	+ +	+ + +	+ + +	
Dramatics	−	−	− −	
Creative writing	− −			
Journalism, school paper	− − −	− − −		−
Photography		+		
Woodworking, cabinetmaking	+			
Metal work, machine shop		+ + +		
Auto repair, rebuilding	+ +	+ + +	+	+ +
Build nonflying plane models	− −			
Build powered model plane	+ + +		+	
Participate in model plane contest				+ +
Work on glider or plane		+ +		
Work Experience				
Skilled manual	+ + +	+ + +	+ + +	+ + +
Minor supervisory			− −	
Simple clerical		− − −		
Higher office work		−	− −	−
Sales clerk, canvasser	− −	−		
Sales—auto, real estate, etc.		−	− −	
Academic		− −		
Instructor or leader	−			
Personal service		− −		
Entertainer			− −	+
No work experience		+ + +		
Reason for Choosing Cadet Training				
Best way to serve			− −	
Prefer duties to other branches	− − −			
Better pay than other branches	−			
To prove can make good	+ + +	−	+ + +	

SUMMARY STATEMENT

This chapter has presented data on six groups of occupations concerned with electricity and electronics. With minor variations, these groups have shown a consistent pattern both of abilities and of biographical data responses. The characteristics of the separate groups are summarized below.

Electrician or Electrical Repairman. The men in this group were above average on the mechanical composite, average on the psychomotor composite, and somewhat below average on the other three groups of tests. The biographical experience pattern of high participation in mechanical and low participation in academic and verbal activities appears here, as it has for a number of craftsmen and mechanic groups, but with an additional suggestion of technical knowledge.

Equipment and Instrument Installer or Repairman. The aptitude pattern of above average mechanical, average psychomotor, and below average other composites is repeated for this group. The familiar pattern of high participation in mechanical activities and low in academic and verbal appears again.

Utilities Electrician. This small group showed very much the same ability pattern as the previous two. The group gave too few significant biographical items to merit reporting them.

Telephone Installer. This group showed quite a flat profile, being very slightly above the total group average on the mechanical and perceptual composites, and somewhat below on the general intellectual and numerical scores. The biographical pattern of limited educational background and limited participation in verbal-social activities appeared once again in this group.

Telephone Linesman. This group was average only on the mechanical composite, falling below on all others, and being especially low on the general intellectual measures. This small group did not yield enough significant biographical item responses to justify reporting them.

Radio or Television Repairman. This group was distinguished by above average performance on the perceptual-spatial tests. Mechanical and psychomotor composites were average, with numerical and general intellectual falling below average. The biographical item response pattern was once more one of low participation in academic-verbal activities, and high in certain mechanical and skilled trades ones.

CHAPTER 23

Construction Trades

In this chapter material is presented on building contractors and on six groupings of construction trades. The six trades were carpenters and floor layers, bricklayers and tile setters, cement finishers and plasterers, sheet-metal workers, plumbers and pipefitters, and painters. More detailed information about the groups is given in the following section.

DEFINITION OF GROUPS

Contractor. Most of the men in this group (about 80%) were classified as falling under the DOT code 0-99.21, Contractor. A man in this group "contracts to perform construction work . . . makes an estimate . . . makes arrangements . . . to provide any necessary financial assistance . . . purchases materials . . . supervises work directly or through subordinate supervisors." The remainder of the group consisted primarily of men classed as 0-99.11, Construction Superintendent. Men in this category are directly responsible for general supervision of some type of contruction work. In our sample there were 153 men who fell in the job grouping of contractors and construction superintendents. The average monthly income reported was \$824. The standard deviation of incomes had the large value of \$508, indicating that the group contained a few men with very large incomes. Average time in the occupation was slightly under 7½ years.

Carpenter. Approximately three-fourths of the men in this grouping fell under the single DOT code 5–25.110, Carpenter (construction). The remainder was scattered over a number of specialized types of carpentry and related jobs. Representative examples were 5–25.150, Carpenter, Finish; 5–25.610, Boatbuilder; 5–25.830, Carpenter, Maintenance; 5–79.020, Carman; and 7–59.220, Carpet Layer. The 98 men in this group reported an average monthly income of \$443, with a standard deviation of \$116. Average time in the occupation was slightly over 7 years.

Bricklayer, Tile Setter. This small group included bricklayers, tile setters, and glaziers. Specific DOT codes that were represented included 5–24.010, Bricklayer; 5–24.130, Bricklayer, Refractory Brick; 7–24.110, Bricklayer, Firebrick; 5–24.410, Tile Setter; and 5–77.010, Glazier. There were only 14 men in the group. They reported an average monthly income of \$461 (no standard deviation reported). Average time in the occupation was almost 8½ years.

Plasterer, Cement Finisher. This was a small group of only nine men. Occupations represented included 5–27.010, Plasterer; 5–26.100, Cement Finisher; and 5–33.110, Asbestos Worker. The group was a somewhat heterogeneous one; the common element might be described as "men who work with a trowel." Average reported income was \$497 (no standard deviation reported), and average time in the occupation was a little over 7½ years.

Sheet-Metal Worker. This grouping included men who work in sheet metal, making a wide range of metal objects of all sorts, including sheet-metal work for the roofing and heating of houses as well as on aircraft. About half of the men in the group fell under the rather inclusive DOT code 4–80.010, Sheet-Metal Worker, and others were classed as 4–80.020, Layout Man; 4–80.050, Sheet-Metal Worker, Aircraft I; 4–80.060, Sheet-Metal Worker, Aircraft II; 4–88.622, Sheet-Metal Worker (ship and boat); and 5–32.761, Lather, Metal. The group numbered only 29 men. Average monthly income was \$491, with a standard deviation of \$110. The men had spent an average of somewhat less than 8 years in the occupation.

Plumber, Pipefitter. This group was composed primarily (about 75%) of plumbers (5–30.210). There were also a few pipefitters (5–30.010) and a few steamfitters (5–30.410). The work of these latter groups tends to be more specialized and more heavy-duty than the work of a plumber in residential construction, but the work is basically similar, involving the cutting, fitting, and assembly of pipelines and related fixtures. Average monthly income reported by the 41 men in this group was $512, with a standard deviation of $123. The men had worked in the occupation for an average of somewhat less than 8½ years.

Painter. The men in this group fell primarily under two DOT codes. About two-thirds were house and construction painters (5–27.010). The other third were primarily spray painters (7–16.210), applying paint to manufactured articles with a spray gun. The total group consisted of only 26 men. Average reported monthly income was $403, with a standard deviation of $115. The men had been in the occupation for slightly over 7 years, on the average.

Foreman. This group was made up of first-line supervisors. The men were working in all types of industries and supervising all types of activities and processes. In this sense they were very heterogeneous. The one thing that all had in common was responsibility for immediate supervision of the worker. The jobs fell under the DOT codes from 5–91 to 5–99, and a great many specific codes were represented. Examples of ones that occurred several times were:

5–91.701	Foreman (printing and publishing)
5–92.411	Foreman (aircraft manufacturing)
5–92.601	Foreman (electrical equipment)
5–92.768	Foreman (machine shop)
5–94.040	Foreman (building construction)
5–95.220	Foreman (telephone and telegraph)
5–95.320	Foreman (heat, light, power)
5–99.020	Foreman (route supervisor)

The group was made up of 160 men. The average monthly income reported by these men was $518, with a standard deviation of $129. The average time spent by each man in his occupation was 7½ years.

MEAN TEST SCORE PROFILES

The mean standard scores for each of the occupational groups on each of the tests of the aircrew battery are shown in Table 23.1. There was a good deal of similarity in most of the profiles. When the standard scores were converted into ranks, and a pooled ranking was prepared based upon all seven construction occupations, the rank-difference correlation of each occupation with the pooled ranking fell between

Table 23.1
Mean Standard Score Profiles of Contractors, Building Construction Craftsmen, and First Line Foremen

	Contractors	Carpenters, Floor-Layers	Bricklayers, Tile-Setters	Cement Finishers, Plasterers	Sheet-Metal Workers	Plumbers, Pipefitters	Painters	Foremen
Reading Comprehension	−4	−24	3	26	2	−16	−43	−15
General Information—Navigator	−1	−41	6	−31	−11	−32	−39	−27
Mathematics	−19	−39	−59	−32	−19	−46	−58	−32
Arithmetic Reasoning	2	−31	−25	−5	−6	−35	−54	−18
Numerical Operations I	−7	−22	−6	3	−59	−31	−6	−15
Numerical Operations II	−15	−19	−2	−18	−34	−8	−13	−23
Dial and Table Reading	−4	−2	−5	−16	−43	−14	−10	−1
Speed of Identification	−5	−13	−13	16	−8	−19	−31	−11
Spatial Orientation I	−13	−10	−48	−30	−38	−20	−12	−17
Spatial Orientation II	−4	13	−27	−19	−17	−32	−11	−12
Mechanical Principles	22	22	42	13	38	−13	−31	−16
General Information—Pilot	0	−9	34	3	14	7	0	−2
Two-Hand Coordination	24	16	−26	−17	12	15	−25	18
Complex Coordination	13	14	−31	−2	−19	19	−2	2
Rotary Pursuit	12	3	−6	8	−5	9	−7	5
Finger Dexterity	1	−2	−1	39	−5	−4	−12	−4
Aiming Stress	−14	−18	−48	−21	−35	−36	−37	−24
Discrimination Reaction Time	4	−9	−49	−72	−50	−2	−17	−9
Biographical Data—Pilot	31	16	7	10	7	−17	1	17
Biographical Data—Navigator	−11	−46	−38	−70	−51	−60	−25	−18
N	153	98	14	9	29	41	26	160

0.70 and 0.79 for all occupations except painter. The correlation of painters with the pooled rank was 0.54. The foremen, who were not included in the pooling, correlated 0.77 with the pooled rank.

A pooled rank has been prepared for the occupations described in each of the last four chapters. The similarity in general pattern for the occupations in these chapters can be seen in tabular form below.

		Chapter 21	Chapter 22	Chapter 23
Chapter 20	Craftsmen	0.83	0.82	0.62
Chapter 21	Mechanics		0.93	0.80
Chapter 22	Electrical			0.82
Chapter 23	Construction			

There was clearly a strong core of general similarity, though it was less between the construction workers and the craftsmen than among the others of these groups.

A condensed report of the test results, arrived at by combining related tests into composites is presented below.

	Contractors	Carpenters	Bricklayers	Plasterers	Sheet-Metal Workers	Plumbers	Painters	Foremen
General intellectual	-7	-44	-24	-14	-11	-42	-63	-30
Numerical	-10	-17	-15	-12	-55	-21	-12	-16
Perceptual-spatial	-10	-4	-38	-14	-27	-31	-24	-17
Mechanical	34	24	10	3	25	-7	-25	-8
Psychomotor	5	-1	-32	9	-24	-5	-22	-8

The general trend of doing rather well on mechanical and psychomotor tests and relatively poorly on general intellectual measures was evident again in these groups. However, variations were sufficiently marked so that each group calls for individual comment.

The contractors showed a flat and nearly average profile on all composites except the mechanical one. On this the group was definitely above average. Carpenters were above average on the mechanical composite and well below average on the general intellectual one. Their other scores were close to the Aviation Cadet average. The small group of bricklayers was a little above average on the mechanical tests and somewhat below average on the other composites. The very small group of plasterers and cement finishers showed quite a flat and near-average profile, though it was tipped up slightly at the mechanical-psychomotor end. Sheet-metal workers were above average on mechanical, well below average on numerical, and somewhat below average on the other composites. Plumbers were near average on the mechanical and psychomotor composites, lowest on general intellectual, and somewhat below average on numerical and perceptual-spatial tests. Painters were near average on the numerical tests, well below average on the general intellectual composite, and somewhat below average on the others.

The group of foremen in all types of industries was included in this chapter because they resembled the groups of this chapter more than those of any other in their pattern of test scores. The score pattern for foremen was fairly clearly that of men in skilled trades rather than that of managers. They were highest on the mechanical tests and lowest on the general intellectual composite. Scores graded down from mechanical through psychomotor, numerical and perceptual-spatial to the intellectual or academic. The profile was a fairly flat one, but the direction seemed clear.

BIOGRAPHICAL DATA ITEM RESPONSES

Examination of the Biographical Data Blank item responses indicated that for two of the groups, bricklayers and plasterers, the number of items differing significantly from the total group of respondents was too small to justify reporting and interpretation. The significant items for the remaining five groups are summarized in Table 23.2.

There was a substantial core of similarity in the responses that showed up as significant for these groups, and these were in large measure the items that characterized the groups described in the preceding three chapters. Items that were significant at least at the 0.10 level for four out of the five groups were the following: little prewar schooling, mother had little schooling, no college major, little participation in tennis, handball, ping-pong or badminton, large percentage having adjusted a carburetor, large percentage having built or helped build plane or glider, large percentage having worked at skilled manual work, few having worked as instructor or leader. The picture is of a group that tended to be less interested and successful with ideas and people than with things. The picture is elaborated somewhat in the data for specific groups.

The contractors came from a somewhat prosperous (i.e., owning good car) nonurban background, with homes characterized by abundant tools. This group did *not* differ significantly from the total group of respondents in either books in the home or parental education. However, the men themselves tended not to have gone to college, and showed a deficit in successful participation in economics and foreign languages. Other subjects did not differ significantly from the total group, except for mechanical drawing and shop work, on which the group was high. The group was high on a number of sports activities, primarily of an individual and thing-oriented nature (boxing or wrestling, diving or ski jumping, marksmanship, auto or motorboat racing, motorcycling, horsemanship). A number of activities and hobbies of a mechanical nature were engaged in by large percentages of the group, i.e., repairing a radio, amateur motion pictures, woodworking, auto repairing or rebuilding. In addition to skilled manual work, prewar experience had relatively frequently included minor supervisory work and work of an engineering nature. Types of work experience occurring relatively infrequently included retail selling, academic work, and work as an instructor or leader, work in public relations and as an entertainer.

Table 23.2
Significant Biographical Data Responses of Construction Workers

	Contractors	Carpenters	Sheet-Metal Workers	Plumbers	Painters	Foremen
General Family and Personal Background						
Lived mostly in the city	–					–
Many books in the home		– –	– –	– – –		– – –
Many tools in the home	+ + +	+ +	+ +			+ + +
Had some college education	– –	– – –	– – –	– – –	– – –	– – –
Father graduated from high school		– –		– – –	– –	– –
Father of American stock			+			
Mother graduated from high school		– – –	–	– – –	–	– – –
Parents strongly favored joining Air Force						+ +
Duration of interest in aviation career						+ + +
Family owned expensive car	+ + +					– – –
Is a good safe driver				+		– –
Has driven or ridden motorcycle	+ + +					+
Family or close friend has been a pilot	+ +	– –	– –			
Major Subject in College						
Did not attend college	+ + +	+ + +		+ + +	+ + +	+ + +
Social sciences or philosophy		– –				– –
Education		–				
Business, commerce, journalism				–		– –
Biological science, medicine						–
Physical science, mathematics, engineering		– – –		– –	–	
School Subjects Studied and Done Well						
Algebra		– –				
Dramatics		– –				– –
Economics	– – –	– –			– –	– –
English		–			– –	
Foreign languages						– –
History	– – –	– – –				
Mechanical drawing	+ +					
Music						
Physical training						– – –
Physics				+ +		+
Public speaking		– – –	–	– –		
Shop work	+ + +	+ + +	+ +			+ + +
Trigonometry		– – –		– –	– –	

Table 23.2 *(Continued)*

	Contractors	Carpenters	Sheet-Metal Workers	Plumbers	Painters	Foremen
Sports Participated in and Done Well						
Boxing, wrestling, water polo	+ +					
Tennis, handball, ping-pong, badminton	−	− − −	− − −		− −	− −
Diving, ski jumping	+ +				−	
Marksmanship	+ +					+
Auto, motorcycle, motorboat racing	+ + +					
Horsemanship	+		−			+
Activities Done a Number of Times						
Sell article to customer		−				
Write technical report		− − −				
Arrange club entertainment		− − −	−			−
Write essay or poem		− − −				
Interview men for job	+ +					
Arrange flower garden		+ + +	+ +			
Repair radio set	+ + +		+ +			
Solicit for a charity		−				
Make a speech		− −				− −
Adjust carburetor	+ +	+ + +	+ + +	+ + +		+ + +
Hobbies and Free-Time Activities						
Amusements (dancing, movies)			− − −	− −	−	
Painting, sketching				− −		
Music		− −				− − −
Collecting (stamps, etc.)						− −
Dramatics		− −	−			
Creative writing		− −				− − −
Journalism, school paper		−	−		− − −	−
Boy Scouts					− − −	− − −
Photography					+ +	+ +
Amateur motion pictures	+ +					+ + +
Woodworking, cabinet-making	+ + +	+ + +				+
Sheet-metal work			+ + +	+ +		+ +
Metal work, machine shop			+ + +			+ + +
Auto repair, rebuilding	+ +	+ + +	+ + +	+		+ + +
Build nonflying plane models						− −
Work on glider or plane	+					

Table 23.2 *(Continued)*

	Contractors	Carpenters	Sheet-Metal Workers	Plumbers	Painters	Foremen
Work Experience						
Unskilled manual		+ + +			+	
Skilled manual	+ + +	+ +	+	+ + +	+ +	+ + +
Minor supervisory	+ + +					
Engineering, drafting, surveying	+					
Simple clerical		− − −	− −			
Higher office						− −
Sales clerk, canvasser	− −	−	− −	+ +		
Sales—auto, real estate, etc.		−				
Managerial		−	−			
Academic	− − −					
Instructor or leader	− − −	− −	−	+		
Reporter, lawyer, advertising	−					
Personal service						−
Entertainer	− −			+	− −	− − −
Protective service			+ +			
No work experience						+ + +
Reason for Choosing Cadet Training						
Prefer duties to other branches				− −		−
Better pay than other branches	+ +					
To use training after war	− −			− −		
To prove can make good			+ +			

The fairly large group of carpenters also showed a rather clear pattern of biographical responses. The pattern of limited education for both the man and his parents was quite marked, and was accompanied by few books in the home. Relatively few of the men had prewar college experience, and deficits appeared in majors in social science, education, and physical science. Low participation and accomplishment were found for a large number of the academic and verbal (i.e., public speaking) subjects. The only subject on which the group was high was shop work. The group was low on quite a variety of expressive and interpersonal activities—selling an article, writing a report, arranging an entertainment, making a speech, music, dramatics, creative writing. It was high on activities of a mechanical and manual nature—arranging a flower garden, adjusting a carburetor, woodworking, auto repair. These men tended to have worked at unskilled as well as skilled manual work before the war, but not at clerical and office work, selling, and managerial work.

The pattern for sheet-metal workers was less well defined, the group being smaller, but repeated the nonacademic, thing-directed pattern we have seen above. The men were low in amount of prewar schooling, and the pattern of many tools but few books in the home was repeated. However, there was no clear pattern of high or low performance in school subjects. Sports participation showed up only in low participation in tennis, etc., and in horsemanship. This group showed up as high on a number of manual activities and hobbies—making a flower garden, radio repair, sheet-metal working, and machine shop, as well as work with automobiles. Work experience was relatively high for skilled manual and protective services, and low for such categories as clerical and sales.

The general pattern for plumbers repeated those that we have just been describing, with a marked educational deficit both for the men and their parents. Various types of manual and mechanical activities remained high. However, the pattern was a somewhat sketchy one.

The pattern for painters was also quite a sketchy one. The group was low in education, and to some extent so were their parents. In addition to infrequent attendance at college, the group showed up as low in successful participation in English, economics, and trigonometry. The group was low in participation in journalism and Boy Scouts, but high in photography. Except for the fact of frequent work experience in skilled trades, there was for this group no particular indication of manual or mechanical background as was the case for the other groups considered in this chapter.

The pattern of Biographical Data item responses for the foremen was a fairly well-marked one, showing the pattern that has been characteristic of many of the skilled blue-collar groups. As a group, the foremen had received relatively little formal education prior to World War II, and they came from parents with limited education. Few had a college major of any kind, the deficit appearing primarily in social studies and business. Their academic participation was low in such subjects as dramatics, economics, foreign languages, and music. They were somewhat unlikely to have arranged a club entertainment or made a speech. Hobbies in which they relatively rarely engaged were music, collecting, creative writing, or journalism. They had seldom worked at higher office, personal service, or as an entertainer, and a good many of them had never worked before entering the Air Force.

By contrast, they came from homes with many tools, had considered an aviation career for some time, and had parents who favored their joining the Air Force. They tended to have operated a motorcycle and to have participated successfully in shop courses at school. Many other mechanical items were also high—adjusting a carburetor, photography, amateur motion pictures, woodworking, sheet-metal, and shop work. They were high in the proportion with prewar work in skilled trades.

SUMMARY STATEMENT

This chapter has presented data on contractors, six special groups working in the building trades, and a heterogeneous group of foremen in various industries. A brief summarizing statement will be given for each group.

Contractor. This rather large and prosperous group was clearly above average in the measures of mechanical ability and close to the average of the Aviation Cadet population on the other measures. In biographical background, the group was characterized by some lack in higher education, and by marked strength in mechanical activities of many sorts. The group also showed up well in some sports. Work experience had tended to be in skilled trades, supervisory, and engineering.

Carpenter. These men were above average in mechanical tests and quite low in general intellectual measures. Both the men and their parents tended to have limited education, which was accompanied by low participation in various verbal and interpersonal activities. Participation tended to be high for activities of a manual and mechanical nature.

Bricklayer. This very small group, was slightly above average on the mechanical tests, slightly below average on numerical measures, and well below average on the remaining tests. The group was too small to yield meaningful results on the Biographical Data items.

Plasterer or Cement Finisher. This was another very small group. Their ability test profile was flat and close to the Aviation Cadet average. Again, no report of biographical items was attempted.

Sheet-Metal Worker. The men in this group were above average on mechanical and quite low on numerical tests, with the other composites somewhat below average. On the biographical items, they tended to repeat the nonacademic, thing-oriented pattern that was characteristic of the carpenters (and, in fact, a great many of the blue-collar occupations that we have been considering in recent chapters).

Plumber. These men showed a rather flat test score profile, ranging from slightly below average on the mechanical and psychomotor tests to quite definitely below on the general intellectual measures. On biographical items they showed a marked deficit in education for both men and parents. The pattern of thing-oriented activities appeared, but somewhat sketchily, for this group.

Painter. The men in this group were below average on all test composites, ranging from a small deficit on the numerical tests to a large one on general intellectual measures. This group appeared to be low in educational background, as was true of groups in other skilled trades, but did *not* show the high participation in mechanical and manual activities that was characteristic of many of the other skilled trades groups.

Foreman. The varied group of foremen from all kinds of industries showed what might be considered a prototype skilled trades pattern. The test profile, though fairly flat, graded down smoothly from a high point on the mechanical tests through psychomotor, numerical, and perceptual-spatial to a low on the general intellectual measures. In background, they had received a limited amount of education and had shown relatively poor success in the more verbal subjects or in verbally oriented out-of-class activities. By contrast, they were high on a variety of mechanical items.

CHAPTER 24

Semi-Skilled and Unskilled Workers

This chapter deals with a number of occupations that may be loosely classed as semi-skilled and unskilled. The specific occupations covered are numerous and varied, but for purposes of the present study they have been grouped into ten categories that are described further in the following section.

DEFINITION OF GROUPS

Fabricating Machine Operator. The men in this group fell into a large number of different specific DOT codes. The jobs were in each instance machine-tending jobs. These were machines that formed, shaped, ground, polished, assembled, or fabricated materials. There were, in most instances, one of a kind. Twelve specific DOT's, chosen essentially at random from those included in the group, are listed to illustrate the general nature of the occupations.

6-27.056	Die Cutter
6-19.012	Picker Tender (textile)
7-68.015	Filling Machine Operator

6–27.054	Cutter, Machine
6–88.627	Forming Press Operator
4–88.511	Wire Drawer
6–77.040	Grinder
6–77.330	Roller Operator
6–78.136	Gear-Shaper Operator
6–78.610	Do-All Saw Operator
6–88.016	Strip Mill Operator
7–57.401	Dyer Helper
8–78.14	Driller

These occupations appeared rather heterogeneous. However, the small number of cases combined with the wide variety of specific jobs made this broad grouping necessary. Average monthly income reported by the 45 men in the group was $428, with a standard deviation of $134. The men reported an average of slightly less than 6½ years in their occupation.

Processing Machine Operator. These men were also machine-tenders. They differed from those in the preceding group in that the machines with which they worked baked, pasteurized, distilled, or in some other way treated some raw material or product that is used by industry or the consumer. The number of specific DOT's was again large, and the occupations appear quite varied. A few specific jobs that represent the group are listed below.

4–01.100	Baker
4–07.100	Miller
4–55.010	Absorption Plant Operator
4–74.010	Plater
6–52.757	Briquetter Operator
6–52.770	Chemical Operator
6–55.040	Controlman
7–09.305	Film Making Machine Tender
6–06.510	Condenser Man

This varied group included 45 men, who reported an average monthly income of $424 with a standard deviation of $105. The men reported having spent an average of 6½ years in the occupation.

Production Assembler. The men in this group had jobs requiring them to put together devices, mostly mechanical ones, starting with component parts. The specific devices assembled were quite varied, including sewing machines (6–94.654), communications equipment (7–00.803), electrical equipment (7–00.921), automobiles (7–02.321), and aircraft (7–03.562 and 5–03.552). A few of the jobs involved inspection of assemblies, rather than the actual work of assembling or installing (i.e., 5-03.812). The group was composed of only 28 men. Average monthly income was reported as $396 (no standard deviation available). The men reported an average time spent in the occupation of somewhat more than 7 years.

Miner or Driller. This group was made up of the few men in our sample who worked in mines, mining in some cases for coal and in others for metals. Specific occupations were 5-21.010, Miner; 5-74.020, Blaster; and 5-75.050, Rotary Driller. In addition, there were several mining foremen (5-93.010 and 5-93.110). The group numbered only 10 men. Average monthly income was reported as $484 (no standard deviation available), and time in the occupation averaged a little over 8 years.

Boilermaker, Metalworker. This grouping was made up of occupations included under the two 3-digit DOT codes 4-83, Boilermaker, and 4-84, Structural and Ornamental Metalworker. These men are typically engaged in heavy work of laying out, assembling, or fabricating articles and structures from iron and steel. There were 17 men in the group. Average monthly income was reported to be $484 (no standard deviation available), and the men had spent an average of somewhat over 7 years in the occupation.

Welder or Lead Burner. This group consisted mostly of arc or acetylene welders, included under the DOT 3-digit code 4-85. There were also a few lead burners (4-95.031), who install and repair all types of structures and fittings made of lead. The group included 32 men. Average monthly income was reported to be $445 (no standard deviation available). The men had spent an average of somewhat less than 7 years in the occupation.

Crane Operator. This small group included men who were operators of various types of hoisting and materials-moving equipment. The occupations were those included under DOT 3-digit codes 5-73, Craneman, Derrickman, Hoistman, and Shovelman, and 5-88, Rigger. There were only 13 of these men. Average monthly income was $462 (no standard deviation available) and the men had spent somewhat less than 7½ years in the occupation, on the average.

Earth Mover. These men were operators of various types of earth-moving equipment, such as bulldozers, scrapers, motor graders, or tractors. In general, they fell in the occupations covered by the DOT 3-digit code 7-23, Construction Machinery Operator. The group was small, consisting of only 13 men. Average monthly income was $412 (no standard deviation available) and average time in the occupation was somewhat under 7½ years.

Pumpman. This small group of men was concerned with pumping, filtering, or controlling the flow of liquids. Specific occupations included 7-72.540, Pumpman (petroleum); 7-72.570, Oil Pumper; 6-55.060, Gager; and 7-54.621, Water Filterer. The group included only 12 men, and does not appear to represent a very important and clear-cut group, either in our sample or in the general world of work. Average reported monthly income was found to be \$414 (no standard deviation available), and time spent in the occupation averaged slightly over 8 years.

Laborer. Our group included men working in many different industries and locations who would be classed as unskilled laborers. The total number of these was not large, considering their numbers in the total work force, and this was natural since our sample had been quite highly screened. Laborers numbered 55 in all, and in most instances there were only one or two in a given industry. Average monthly income for these men was \$352, with a standard deviation of \$115. The length of time in the occupation averaged only 5 years, indicating that this was a rather unstable occupational group.

MEAN STANDARD SCORE PROFILES

The profiles of mean standard scores for the two groups of machine operators and the group of production assemblers are shown in Table 24.1. Profiles for the remaining groups are shown in Table 24.2.

The profiles of all the groups considered in this chapter had some general resemblance. When the scores in each profile were ranked and these ranks were correlated with a pooled rank based on all ten of the groups considered in the chapter, the resulting correlations ranged from 0.58 to 0.94. The median rank-difference correlation was 0.72. The pattern was, in general, similar to that encountered in the preceding chapters, and most like that for mechanics, as shown by the following correlations of pooled rankings for the several chapters:

Chapter 24 with Chapter 20, Machinists and handicraftsmen	0.72
Chapter 24 with Chapter 21, Mechanics	0.87
Chapter 24 with Chapter 22, Electrical workers	0.79
Chapter 24 with Chapter 23, Contractors and building craftsmen	0.53

The common feature of the profiles for occupations reported in this chapter is relatively good performance on the mechanical and psychomotor tests and decidedly low performance on numerical and general intellectual measures.

Table 24.1
Mean Standard Score Profiles of Machine Operators and Production Assemblers

	Fabricating Machine Operators	Processing Machine Operators	Production Assemblers
Reading Comprehension	-51	-29	-67
General Information—Navigator	-11	-33	-61
Mathematics	-51	-51	-76
Arithmetic Reasoning	-25	-46	-54
Numerical Operations I	-31	-17	-54
Numerical Operations II	-8	-25	-79
Dial and Table Reading	-23	-59	-55
Speed of Identification	-5	-32	-40
Spatial Orientation I	-21	-52	-37
Spatial Orientation II	-31	-45	-29
Mechanical Principles	-28	-6	-34
General Information—Pilot	-5	-29	-17
Two-Hand Coordination	0	-6	-32
Complex Coordination	-5	-20	-38
Rotary Pursuit	-1	34	6
Finger Dexterity	30	-6	-30
Aiming Stress	0	3	-28
Discrimination Reaction Time	-24	-43	-28
Biographical Data—Pilot	-60	-19	4
Biographical Data—Navigator	-55	-47	-5
N	45	45	28

The main features of the ability patterns for the different occupational groups can be brought out by pooling related tests into five composite scores, as has been done in previous chapters. The standard scores on these composites, expressed as usual in terms of a population mean of 0 and a population standard deviation of 100, are shown below.

	Fabricating Machine Operators	Processing Machine Operators	Production Assemblers
General intellectual	-45	-51	-83
Numerical	-25	-41	-76
Perceptual-spatial	-25	-56	-46
Mechanical	-39	-13	-27
Psychomotor	9	4	-34

	Miners, Drillers	Metal-Workers	Welders, Lead Burners	Crane Operators	Earth Movers	Pumpmen, etc.	Laborers
General intellectual	−43	−29	−61	−66	−71	−55	−33
Numerical	−4	−37	−52	−84	−70	−24	−36
Perceptual-spatial	73	−23	−32	−37	−22	−17	−13
Mechanical	75	−8	−3	−19	−3	−11	−18
Psychomotor	80	−31	3	−29	−37	13	−24

The two groups of machine operators came up to the average of the Aviation Cadet applicant population only on the psychomotor tests. Processing machine operators were near average on the mechanical tests, but those operating fabricating machines were definitely below. On the other composites, both groups fell below average, though by varying amounts.

Table 24.2
Mean Standard Score Profiles of Various Groups of Semi-Skilled Workers and Laborers

	Miners Drillers	Metal Workers	Welders, Lead Burners	Crane Shovel Operators	Earth Movers	Pumpmen and Related	Laborers
Reading Comprehension	5	−14	−33	−71	−36	−29	−16
General Information—Navigator	−64	−19	−55	−32	−72	−42	−33
Mathematics	−44	−39	−69	−70	−75	−56	−36
Arithmetic Reasoning	−30	−17	−30	−32	−37	−42	−16
Numerical Operations I	−6	−39	−36	−51	−43	−40	−34
Numerical Operations II	−16	−20	−34	−79	−49	25	−15
Dial and Table Reading	12	−33	−60	−80	−83	−46	−41
Speed of Identification	37	−7	−31	−56	−32	46	−12
Spatial Orientation I	71	−37	−39	−58	−23	−25	−12
Spatial Orientation II	61	−9	−4	30	5	−59	−5
Mechanical Principles	48	−2	−3	−21	11	−3	−1
General Information—Pilot	−17	15	13	−4	−25	−22	2
Two-Hand Coordination	83	5	−1	0	22	−18	−10
Complex Coordination	61	−47	−18	−36	2	−18	−10
Rotary Pursuit	65	−14	0	−12	−29	31	−13
Finger Dexterity	0	−15	6	−26	−57	36	−29
Aiming Stress	85	−5	20	−4	−15	−14	−11
Discrimination Reaction Time	35	7	−28	−31	−31	−7	−14
Biographical Data—Pilot	39	−22	−3	−22	−39	−4	−30
Biographical Data—Navigator	−4	−55	−83	−34	−84	−63	−53
N	10	17	32	13	13	12	55

The production assemblers were low on all tests—lower even than the common laborers. Their performance on the numerical and general intellectual tests was conspicuously low.

The small group of miners and drillers showed a rather startling profile. They were very high on three of the composites—perceptual-spatial, mechanical, and psychomotor. On these, the group received mean scores as high as any group tested. Of course, one must remember that the group was made up of only ten men, of whom about half were foremen. However, the profile is certainly surprising.

The metalworkers showed an essentially flat, slightly below average profile. There was a very small peak for the mechanical tests. Welders and lead burners, on the other hand, were about average on the mechanical and psychomotor tests, but quite low on the numerical and general intellectual measure. The crane operators were below average on all tests, but a good deal lower on number and intellectual tests than on the others.

Operators of earth-moving equipment were about average on the mechanical composite, but fell very low on the numerical and intellectual tests. The group of pumpmen and men in related occupations were slightly above average on the psychomotor measures, quite low on general intellectual measures, and slightly below average on the other composites.

The men classified as laborers showed a flat, somewhat below average profile. However, their scores were not as low as those in many other occupations. In particular, they fell only about a third of a standard deviation below the Aviation Cadet average on the general intellectual measures. Our best estimates (see Chapter 7) are that the Aviation Cadet applicants averaged well over a standard deviation above the general population average on these measures, so this would mean that the laborers in our sample were still well above the general population average. They were clearly an atypical group of laborers. One suspects that they ended up in unskilled labor not because of limited *ability* but because of other limitations not represented in the tests of our battery.

BIOGRAPHICAL DATA ITEM RESPONSES

Significant Biographical Data item responses for seven of the ten occupational groups covered in this chapter are shown in Table 24.3. For three of the groups, miners, crane operators, and pumpmen, the number of responses significant at the 0.10, 0.05 and 0.01 levels was too small to justify reporting or make any attempt at interpretation. This was probably due in large measure to the fact that these were very

Table 24.3

Significant Biographical Data Blank Item Responses for Selected Semi-Skilled and Unskilled Occupations

	Fabricating Machine Operator	Processing Machine Operator	Production Assembler	Metal Worker	Welder, Lead Burner	Earth Mover	Laborer
General Family and Personal Background							
Lived mostly in the city	−	− −				−	− − −
Many books in the home	− − −	−		− −	− − −	− − −	− − −
Had some college education	− − −	− − −	− − −	− − −	− − −	− − −	− − −
Father graduated from high school	− −	− − −		− −	− − −	− − −	− − −
Father of American stock	− −			−			
Mother graduated from high school	− − −	− −	− −		− − −	− − −	− −
Mother of American stock	− −						
Parents strongly favored joining Air Force						+	
Duration of interest in aviation career				− − −	−		
Family owned expensive car	− −	−			−		− − −
Has driven or ridden motorcycle					+ +		
Family or close friend has been a pilot	−					− −	− − −
Major Subject in College							
Did not attend college	+ + +	+ +	+ + +	+ + +	+ + +		+ + +
Social sciences or philosophy			−				−
Business, commerce, journalism			−	−	−		
Physical science, mathematics, engineering	− − −				− −		
School Subjects Studied and Done Well							
Algebra	− − −	− − −	− − −	− −	− − −	− − −	− − −
Dramatics					−		
Economics				− −	− −		
English	− − −						
Foreign languages			− − −		− −		
History					− − −		
Mechanical drawing	− − −						
Physical training		+					
Physics		− −		− −	− −	−	− −
Public speaking	− −				− −		−
Shop work		+ +	+ + +			+ +	
Trigonometry	− − −	− − −	− −		−	− −	− − −

Table 24.3 *(Continued)*

	Fabricating Machine Operator	Processing Machine Operator	Production Assembler	Metal Worker	Welder, Lead Burner	Earth Mover	Laborer
Sports Participated in and Done Well							
Baseball, softball							–
Boxing, wrestling, water polo			– –	+ +			
Crew, rowing, canoeing							–
Tennis, handball, ping-pong, badminton	– – –		– –	–	– –	–	– – –
Diving, ski jumping	– –						
Track (longer races)							–
Track (field events)			+ + +				
Horsemanship		– –					
Activities Done a Number of Times							
Adjust clock	+ +						
Sell article to customer	– –	– – –		– – –		– – –	– – –
Write technical report	– –	– –		– – –		– –	– – –
Arrange club entertainment	– – –					– –	
Write essay or poem				– – –	– – –		– – –
Interview men for job	– –						
Make a speech				–	– – –	– – –	– –
Adjust carburetor					+ +		+
Hobbies and Free-Time Activities							
Amusements (dancing, movies)							
Music	– –				– – –		
Collecting (stamps, etc.)					– –		– –
Dramatics					–	– –	
Journalism, school paper	– –			–			– – –
Boy Scouts					– –	–	– – –
Photography					– – –		
Amateur motion pictures					– – –	–	– –
Woodworking, cabinet-making			+ +		+ + +		
Sheet metal work			+ +				
Metal work, machine shop	– –						+ + +
Auto repair, rebuilding			+ +				
Build powered model plane			+		+ +		+ + +
Participate in model plane contest							–
							– –

Table 24.3 *(Continued)*

	Fabricating Machine Operator	Processing Machine Operator	Production Assembler	Metal Worker	Welder, Lead Burner	Earth Mover	Laborer
Work Experience							
Unskilled manual		– –	– –				+ + +
Semi-skilled manual			–				
Skilled manual	–	+			+ +		
Engineering, drafting, surveying		–	–				
Simple clerical	– –	– – –	– –				– –
Higher office work							–
Sales clerk, canvasser		–	– –	– – –	– –	– –	– – –
Sales—auto, real estate, etc.	–						–
Managerial	–						
Academic	–	–					
Instructor or leader		–		– –		– –	
Personal service						–	–
Entertainer		+					
No work experience	+ + +			+ +		+ +	+ + +
Reason for Choosing Cadet Training							
Love of adventure				–	– – –	–	+
Feel have aptitude	– –	+	– – –				–
Prefer duties to other branches					–		
To use training after war				+ +			
To prove can make good			– – –				+ +

small groups, so that differences had to be quite large if they were to reach the required levels of significance.

The seven occupations that are shown had a good deal in common in the biographical item patterns. The dominant theme was one of meager academic background and success. Thus, at least five of the seven groups tended to have few books in the home, not to have gone to college prior to entering military service, to have come from parents with limited education, to have had no college major, to have rarely participated successfully in algebra, physics, or trigonometry, or to have written a technical report. The fact that the men in these groups showed little participation in the group of sports including tennis, handball, ping-pong, and badminton probably reflects family social status, and lack of opportunity rather than lack of skill. The groups tended also to have been low in participation in sales activity.

Individual occupational groups also exhibited further characteristics of some interest. Fabricating machine operators tended to be of foreign-born parentage, with few owning an expensive car. In school they showed up poorly on English, mechanical drawing, and public speaking as well as algebra and trigonometry. They had rarely arranged a club entertainment or interviewed men for a job. They had infrequently engaged in music, journalism, or metalworking as free-time activities. Many of them reported no work experience of any kind prior to their military service.

Processing machine operators included some excess of men who had done well in shop work in school. Many of them had participated in none of the hobbies described in the blank. They were low in participation in academic and instructor work experiences as well as in sales.

Production assemblers were high in shop work and low in foreign languages as well as algebra and trigonometry as school achievements. They reported a high rate of successful participation in track field events. Free-time activities of amateur motion pictures, woodworking, and metalworking were frequently mentioned. The group was low on several items of work experience, including unskilled, semi-skilled, and clerical as well as sales. They mentioned infrequently, as reasons for choosing Aviation Cadet training, a feeling that they had aptitude for the job or a feeling of need to prove themselves.

The metalworkers were low in the percentage who had planned for a long time to be aviators. They showed some tendency to be high on the sports of boxing and wrestling. A small percentage of them had written an essay or poem or made a speech. They were high in the percentage with no prewar work experience. A high percentage of them expressed the hope of using their flying training after the war.

The welders were somewhat more nonacademic than the other groups, showing low success on a number of academic subjects. They were low on writing an essay or poem or making a speech. They were low on many hobby activities—especially those of a linguistic or esthetic nature. They were high only on the hobbies of amateur motion pictures and auto repairing. They infrequently mentioned liking for an adventurous life as a reason for joining the Air Force.

The earth movers showed a scattering of minus differences, often in activities of a verbal or interpersonal nature. The same tended to be true, but perhaps even more markedly, for the laborers. They were low on a number of school activities and on out-of-school activities of a verbal or esthetic nature. They were, however, high on a couple of manual-mechanical activities, i.e., sheet-metal work and auto rebuilding and repair.

SUMMARY STATEMENT

In this chapter material has been presented on a variety of semi-skilled and unskilled jobs. In terms of biographical background, the general impression conveyed by these groups was one of meagerness—meagerness of educational background, meagerness of cultural resources, meagerness of participation in cultural activities, and meagerness in variety and range of hobby or work experiences. Though there were isolated instances of high participation in manual and mechanical activities, this was much less true of these men than it was of those working as craftsmen or as skilled manual workers.

With the exception of a small group of miners, who showed extraordinarily high scores on a number of the tests, test performance for these groups was also generally low. Psychomotor and mechanical test means were average or only slightly below average for many of the groups, but general intellectual and numerical test scores were typically very low. Such groups as production assemblers, welders, crane operators and earth movers had mean scores on these composites ranging from half to three-fourths of a standard deviation below the Aviation Cadet mean. Interestingly enough, the group of laborers did better on these tests than many of the semi-skilled and even a number of the skilled groups.

CHAPTER 25

Transportation Workers

This chapter presents data on four groups of vehicle operators and transportation workers. The groups, in the order in which they will be discussed, are airplane pilots, control tower operators and dispatchers, bus and truck drivers, and railroad engineers and trainsmen. The groups will be described more fully in the following paragraphs.

DEFINITION OF OCCUPATIONAL GROUPS

Airplane Pilot. With one or two exceptions the men in this group were classed as 0-41.10, Airplane Pilot, Commercial. The specific nature of their flying duties varied considerably, since some were airline pilots, some were staff pilots for private concerns, and some were flying planes for other types of service. There were also one or two test pilots (0-41.12) included in the group, which numbered 127 men. Average monthly income reported by the pilots was $716, with a standard deviation of $225. The men had been employed in the occupation for only a little over 5½ years on the average. These were certainly practically all men who had completed pilot training in the

Air Force, and who might have gone directly into flying as a postwar job. The relatively short average time in the occupation suggests that many of them tried some other type of work for awhile after leaving the Air Force, and then gravitated back into flying.

Control Tower Operator or Dispatcher. This group was made up primarily of airplane control tower operators (0-61.60). These men maintain radio and other types of contact with planes coming to and leaving an airport, and direct traffic in and out of the airport. There were also a few airplane dispatchers (0-61.61), who have responsibilities for authorizing and directing airplane flights. Total number in the group was 25. Average monthly income was reported to be $526 (no standard deviation available). The men had worked in the occupation for just under 8 years, on the average, and thus appear to be a stable group, composed in large part of men who had engaged in this work ever since they had left the Air Force.

Bus or Truck Driver. This group included various types of operators of motor vehicles, but the overwhelming majority were truck drivers, coded either as 7-36.25, Truck Driver, Heavy or 7-36.26, Truck Driver, Light. There were also a number of bus drivers (5-36.010), and a scattering of motor vehicle operators of other types. There were 87 of these vehicle operators in all. They reported an average monthly income of $405, with a standard deviation of $123. Average time in the occupation was only a little over 6 years, so that this appears to have been one of the less stable occupational groups.

Railroad Engineer or Trainman. This group was made up of railroad operating personnel. The majority of the group were coded either 5-41.10, Locomotive Engineer, or 5-42.10, Fireman. There were a few coded 5-38.01, Brakeman; and 5-44.01, Switchman; and one or two coded 5-43.10, Street Car Motorman. The group consisted of 39 men, who reported an average monthly income of $479 with a standard deviation of $104. Average time in the occupation was slightly over 8 years.

MEAN STANDARD SCORE PROFILES

The mean standard scores for each of the four occupational groups on each of the 20 scores obtained from the aircrew test battery are shown in Table 25.1. The four groups show some resemblance in their score profiles, as evidenced by the following rank-difference correlations:

	2	3	4
1. Airplane pilots	0.33	0.55	0.84
2. Control tower operators		0.67	0.41
3. Bus and truck drivers			0.55
4. R. R. engineers, etc.			

The pattern tended to be the same one that we have seen repeatedly in recent chapters. The pooled ranks for this chapter correlate, for example, 0.87 with the pooled ranks of the electrical workers described in Chapter 22. The picture is the now familiar one of high mechanical and psychomotor scores accompanied by markedly lower performance on the general intellectual tests.

Table 25.1
Mean Standard Score Profiles for Airplane Pilots, Control Tower Operators, Dispatchers, Bus and Truck Drivers, Railroad Engineers, Trainmen

	Airplane Pilots	Control Tower Operators, Dispatchers	Bus and Truck Drivers	Railroad Engineers, Trainmen
Reading Comprehension	6	9	−37	−28
General Information—Navigator	−11	3	−48	−42
Mathematics	−25	−2	−50	−52
Arithmetic Reasoning	−18	1	−30	−33
Numerical Operations I	−28	24	−20	−22
Numerical Operations II	−23	23	−8	−31
Dial and Table Reading	0	44	0	−38
Speed of Identification	12	33	−13	−15
Spatial Orientation I	8	23	−24	−19
Spatial Orientation II	22	16	−16	−37
Mechanical Principles	38	35	−17	10
General Information—Pilot	40	17	0	−9
Two-Hand Coordination	58	44	−4	22
Complex Coordination	49	32	−6	21
Rotary Pursuit	43	37	−3	2
Finger Dexterity	22	4	−22	−1
Aiming Stress	1	36	−23	−24
Discrimination Reaction Time	18	14	−29	−9
Biographical Data—Pilot	48	−10	−11	15
Biographical Data—Navigator	−23	−17	−39	−57
N	127	25	87	39

A condensed picture, expressed in terms of five score composites is shown below:

	Air-plane Pilots	Control Tower Operators	Bus and Truck Drivers	Engineers, Trainmen
General intellectual	-16	4	-53	-50
Numerical	-20	37	-11	-37
Perceptual-spatial	18	31	-23	-31
Mechanical	64	31	-14	21
Psychomotor	43	41	-20	-1

The airplane pilots were among the highest groups of all those that we have studied on the mechanical and psychomotor tests. They were slightly below average on the general intellectual and the numerical tests. In evaluating these results, however, one must remember that a primary condition of employment as a pilot was having received pilot training in the Air Force. Selection for pilot training in the Air Force was based primarily on score on these same mechanical and psychomotor tests, so it is hardly surprising that those found to be working as pilots were high on them.

The control tower operators were above average, and about equally so, on all of the test composites except the general intellectual one. On the general intellectual measures they were about average. In this group, also, it is possible that selection for training as control tower operators during the war, or for flying training, may have been a factor facilitating entry into the occupation and that the ability profile may reflect these wartime selection factors.

Railroad engineers and trainmen showed a wider range of performance on the different groups of tests. On the mechanical tests they were somewhat above average, and on the psychomotor tests almost exactly average for the Aviation Cadet population. They were below average on the other composites, and especially so on the composite of general intellectual tests.

BIOGRAPHICAL DATA BLANK ITEM RESPONSES

Only two of the occupational groups showed a large enough number of Biographical Data item responses that differed significantly from the general respondent group to justify reporting and interpretation. The results for these two groups, pilots and bus and truck drivers, are shown in Table 25.2.

Table 25.2

Significant Biographical Data Item Responses for Airplane Pilots and Bus and Truck Drivers

	Airplane Pilots	Bus and Truck Drivers
General Family and Personal Background		
Lived mostly in the city	–	
Many books in the home	–	– – –
Many tools in the home	+ + +	
Had some college education	– –	– – –
Father graduated from high school	– –	– – –
Father of American stock	+	
Mother graduated from high school		– – –
Duration of interest in aviation career	+ + +	
Has driven or ridden motorcycle	+ + +	
Family or close friend has been a pilot	+ + +	
Major Subject in College		
Did not attend college	+ +	+ + +
Social sciences or philosophy	–	– –
Business, commerce, journalism	–	
Biological science, medicine		–
Physical science, mathematics, engineering		– – –
School Subjects Studied and Done Well		
Algebra	– – –	– – –
Economics	– –	
English	–	– – –
Foreign languages		– – –
History	– – –	–
Mechanical drawing	+ +	–
Physics	–	– – –
Public speaking	– – –	– –
Shop work	+ +	
Trigonometry	– – –	– – –
Sports Participated in and Done Well		
Boxing, wrestling, water polo		–
Crew, rowing, canoeing		– – –
Tennis, handball, ping-pong, badminton		– – –
Sailboating		–
Auto, motorcycle, motorboat racing	+ + +	

Table 25.2 *(Continued)*

	Airplane Pilots	Bus and Truck Drivers
Activities Done a Number of Times		
Write technical report	–	– –
Arrange club entertainment	–	– –
Write essay or poem	– –	– – –
Interview men for job	–	
Make a speech	– – –	– –
Adjust carburetor	+ + +	+ + +
Hobbies and Free-Time Activities		
Collecting (stamps, etc.)		– – –
Dramatics		– –
Creative writing	– – –	
Journalism, school paper	– – –	– – –
Photography	+	
Amateur motion pictures	+	
Sheet-metal work	+ + +	+
Metal work, machine shop	+	
Auto repair, rebuilding	+ + +	+ + +
Build powered model plane	+ + +	
Participate in model plane contest	+ +	
Work on glider or plane	+ + +	
Work Experience		
Unskilled manual	+	
Semi-skilled manual		+
Skilled manual	+ + +	+
Engineering, drafting, surveying		– – –
Simple clerical	– – –	
Sales clerk, canvasser		– –
Sales—auto, real estate, etc.	–	
Academic	–	–
Instructor or leader	– –	– – –
Entertainer		– –
Reason for Choosing Cadet Training		
Love of adventure	+ +	–
Best way to serve	–	
To use training after war	+ +	
To prove can make good		+ +

The pilots, naturally enough, showed up positively on practically all of the items on the blank that related to flying. They tended to have seriously considered aviation as a career for a long time; they had frequently had relative or friends who were licensed airplane pilots; they had worked on flying plane models, engaged in model plane contests, and worked on building a glider or plane; they reported expecting to use their flight training after leaving the Air Force.

In spite of their relatively good ability, the pilots tended to have had limited prewar education and to have had fathers with limited education. They were low in participation and success in such academic subjects as algebra, economics, history, physics, public speaking, and trigonometry, and were high only in mechanical drawing. They were low also on a number of verbal and interpersonal out-of-school activities, e.g., writing a technical report, arranging a club entertainment, writing an essay or poem, interviewing men for a job, making a speech, painting and sketching, clerical work, academic work, or work as an instructor or leader.

By contrast these men were high on many activities involving things or machines. Their homes tended to contain many tools. Many of them had ridden or driven motorcycles, engaged in auto, motorcycle, or motorboat racing, adjusted a carburetor, had a hobby of photography or motion pictures, done metal or sheet-metal work, repaired or rebuilt autos, and worked in skilled trades. Thus, they could be described, in summary, as a rather bright but nonacademic group with outstanding mechanical ability and evidences of strong mechanical interest.

The biographical background of the bus and truck drivers presented a much more negative picture. These men were characterized primarily by what they were *not*. They were *not* academic. Coming from homes with few books and from parents with limited education, they themselves tended to have had little prewar education and to have had limited success in what they had had. They were *not* particularly athletic, though low participation in some sports, such as sailboating, may have been merely a reflection of limited economic background and opportunity. They were *not* very active participators in verbal, social, and interpersonal activities—arranging a club entertainment, making a speech, dramatics, journalism, working as a salesman, instructor or leader, or entertainer. About the only items on which they were high were those related to automobiles.

SUMMARY STATEMENT

This chapter has presented data on four groups working in transportation. The results for each group are summarized briefly below.

Airplane Pilot. These men achieved very high scores on the mechanical and psychomotor tests, slightly above average on perceptual-spatial, and slightly below average on numerical and general intellectual. The pattern certainly resulted in part from the procedures used for selecting men to receive pilot training. On biographical items, these men were high on all those relating to aviation and on many related to mechanics, but they tended to be low on items of an academic nature.

Control Tower Operator or Dispatcher. Men in this group were above average, and about equally so, on all the test composites except the general intellectual one. On this composite they were about average. Significant Biographical Data items were too few to justify reporting and interpretation.

Bus or Truck Driver. This group fell just a little below average on all composites except the general intellectual one, on which they fell well below average. The biographical item responses characterized these men primarily as a nonacademic group, not participating very much in verbal or interpersonal activities related to school.

Railroad Engineer or Trainman. This group showed a test profile that was above average on mechanical tests, very close to average on psychomotor, and below average on the others—especially the general intellectual composite. Significant biographical items were too few to justify reporting and interpretation.

CHAPTER 26

Multiple Discriminant Analysis

In the preceding 18 chapters we have seen the characteristics of the individuals in single occupations. We have seen the profiles of particular occupations on 20 single tests and we have also seen these profiles for the five composite scores based upon pooling of related tests. We have noted that certain occupations tended to be highest on the intellectual type of measure and that others tended to be higher on the psychomotor and mechanical types of tests. We may now raise the question as to how well the tests, taken collectively, discriminate among the occupations, taken collectively. In other words, to what extent are the people who went into certain occupations different from those who went into other occupations? If we were to use the tests as effectively as it were possible to do so, how sharp a discrimination could we make among individuals in different occupations?

It is in an attempt to answer this kind of question that Phillip J. Rulon at Harvard and his students and co-workers have developed the statistical techniques of multiple discriminant analysis. Multiple discriminant analysis undertakes to take a set of test variables as applied to individuals in a number of different categories and to weight the test variables in such a way as to maximize the discrimination among the different categories. That is, the variation among groups is made a maximum and the variation within groups reduced to a minimum. The first discriminant is that one linear combination of the test scores which will give the maximum discrimination among the occupations. Having accomplished the maximum discrimination that can be accomplished by one linear combination of the separate tests, one may then combine them in a new way (unrelated to the first combination) so as to get the maximum amount of discrimination from this new linear combination of the tests. This, then, is the second discriminant. The procedure may be repeated and successive discriminants identified, each accounting for a smaller fraction of the total discrimination among all the groups. Finally, one will have extracted a number of discriminants equal to either the number of tests or one less than the number of groups, whichever is smaller. These collectively represent the total discrimination that can be achieved among the groups using the tests that are available.

In studies that have been made using this procedure it has ordinarily been found that two or three discriminants account for most of the discrimination that is possible among the groups being studied. Further discriminants beyond the second or third appear to be negligible in most cases. As applied to our data then, the problem became that of determining the two, three, or possibly more linear combinations of our 20 predictor tests that would give the maximum discrimination, each in turn, among the occupations with which we were dealing.

At the time that this analysis was started, the task of carrying out a discriminant analysis of more than 100 different occupational groups seemed rather overpowering. Therefore, it was decided to limit the analysis to a smaller number of the occupational groups. We selected 22 groups for use in the multiple discriminant analysis. The basis for choosing particular occupations to be included was somewhat intuitive. We tended to limit ourselves to the larger groups and also to those that were perceived as being more homogeneous in composition. There was some tendency to limit ourselves to groups that seemed to play a significant role in our contemporary society. We made the further decision to carry out the analysis on groups at approximately the same *level* in the occupational structure rather than to include higher level and lower level groups in the same analysis. Thus, the discrimination tended to become one among types of occupations at roughly the same level rather than among levels of occupation. One reason for limiting ourselves to groups at the upper occupational levels was a feeling that the preselection in our total Aviation Cadet population was such that the groups that we had from the lower occupational levels were not really very representative of the totality of individuals working in those occupations. Analysis was eventually carried out on the 22 occupational groups listed below.

1. Accountants and auditors
2. Physical scientists
3. Physicians
4. Civil engineers
5. Electrical engineers
6. Industrial engineers
7. Mechanical engineers
8. Sales engineers
9. Specifications writers and estimators
10. Lawyers
11. Pharmacists
12. High school teachers, miscellaneous
13. Airplane pilots
14. Draftsmen
15. Managers of hotels and restaurants
16. Managers of retail stores
17. Presidents, vice presidents, and secretaries of companies
18. Office managers
19. Industrial managers
20. Sales managers
21. Salesmen of household hard goods
22. Salesmen of industrial hard goods

In the analysis of this material four linear combinations of the test scores were extracted in turn, corresponding to the first four discriminants. The size of these four discriminants can be judged by the size of the corresponding latent roots. These are the roots of a product matrix $W^{-1}A$, which is the product of the inverse of the matrix of within-groups variances and covariances times the matrix of among-groups variances and covariances. In our problem the values of the four latent roots were found to be as follows: root 1, 0.211; root 2, 0.098; root 3, 0.031; root 4, 0.025. The sum of all 20 roots for our 20 predictors was found to be 0.471. This means essentially that the variance among groups is slightly less than one-half the size of the variance within groups, or that somewhat less than one-third of the total variance is to be accounted for by differentiation among our sample of 22 groups.

These results may be viewed from two rather different angles. One is from the point of view of their statistical significance; the other is from the point of view of their practical and descriptive interpretation. As far as the statistical significance is concerned, a significance test developed by Dr. Rulon indicates without any question that the discrimination among the groups is real and not a chance matter. The difference is significant at well beyond the 0.01 level. As we examine the successive latent roots there would be no question that the first one is significant, and it seems very likely that the second one is also. The third and the fourth seem very much more questionable, and there is certainly no reason to think that latent roots beyond these four would have any significance either statistical or practical.

When it comes to the matter of the practical discrimination among the groups that we studied, our reaction must be somewhat less enthusiastic. Taking account of all the possible discrimination from all possible combinations of our tests, it is still true that we can differentiate our groups only to the extent that about one-third of the variance. This much is variance among groups, whereas the remaining two-thirds is still variance within the groups. In the case of any single latent root, of course, the situation is much less favorable even than that. That is, our first and largest latent root is one in which approximately one-sixth of the variance is variance among group means and the other five-sixths is variance within groups. For our second latent root less than one-tenth of the variance is variance among groups. For any further latent roots the discrimination among groups is so small as to be almost negligible.

The nature of the discriminants can best be appreciated by examining the latent vectors or, in other words, the weights to be applied to the 20 tests in our prediction battery. These latent vectors are shown in Table 26.1 for the first four discriminants. Interpretation of these latent vectors is somewhat troublesome. They are not to be clearly identified with simple psychological factors. The interpretation is made somewhat more confusing still by the fact that the Biographical Data Blank—Navigator score, a score which does not have very clear psychological meaning, occurs with heavy weight in each one of the latent vectors.

The first latent vector tends to contrast navigator score on the Biographical Data Blank with navigator score on the General Information test and with the Mathematics test. One might say that it discriminates between the person who really knows mathematics, trigonometry, and similar concepts and the person whose background looks as if he ought to know them. The simple tests of numerical operations go with the Biographical Data Blank—Navigator, and again perhaps we can interpret our results as discriminating between the person who functions with numbers and numerical ideas at a simple level, but who does not have very good academic background or academic com-

Table 26.1
Normalized Latent Vectors Applicable to Test Scores Expressed as Standard Scores

Test	Vector 1	2	3	4
Reading Comprehension	−0.011	0.218	0.206	−0.097
General Information—Navigator	−.417	.365	−.309	.074
Mathematics	−.760	−.116	.184	−.254
Arithmetic Reasoning	−.011	.169	−.266	.419
Numerical Operations I	.125	.137	−.086	.119
Numerical Operations II	.074	.001	−.021	−.225
Dial and Table Reading	.049	.158	.128	.328
Speed of Identification	−.088	−.085	−.111	−.342
Spatial Orientation I	−.005	−.033	−.139	−.086
Spatial Orientation II	−.124	−.004	−.044	−.217
Mechanical Principles	−.176	−.342	−.206	.169
General Information—Pilot	−.078	.402	.241	−.244
Two-Hand Coordination	.040	−.113	−.120	.430
Complex Coordination	−.031	−.143	−.121	.087
Rotary Pursuit	.004	−.067	.073	.122
Finger Dexterity	.027	−.137	−.188	.213
Aiming Stress	−.013	−.023	.116	.073
Discrimination Reaction Time	−.022	.066	.181	−.123
Biographical Data—Pilot	−.224	−.459	.300	.060
Biographical Data—Navigator	.333	.418	.628	.188

petence as represented by knowledge of mathematical concepts of a high school program, and one who is mathematically somewhat more sophisticated.

The second dimension seems to have a little clearer meaning and seems to correspond to the differentiation between a mechanical and an intellectual type of ability. We can speculate that if a larger number of simple mechanical types of jobs had been included in our analysis, this might have become a much more dominant factor and perhaps the first factor in the discrimination.

The third and fourth factors account for such a small amount of discrimination among the occupations that no interpretation of their nature will be attempted.

Another way of giving some content to the results of this multiple discriminant analysis is to compute the position of the mean of each of the occupational groups with respect to each of the four discriminant vectors. Again, little attention should be paid to the position on the third and fourth vectors because of the small amount of discrimination shown in these and because of their general obscurity. The values of the occupational group means for each of the four vectors are shown in Table 26.2. The results for the first two vectors are plotted in Figure 26.2. An inspection of Table 26.2 or Figure 26.1 will readily identify the occupations high on each of the vectors as well as low on each of the vectors in turn.

An examination of Figure 26.1 shows that the first discriminant dimension places engineers, physical scientists, and physicians at one end and salesmen, store managers, and hotel and restaurant managers at the other. The differentiation is apparently based primarily on the Mathematics Test and the mathematics score of the General Information Test, because the engineer groups are very high on these tests and the sales and retail management groups quite low. (The plus and minus directions on a discriminant axis are essentially arbitrary, and have no fundamental meaning.)

Table 26.2

Coordinates of Occupational Group Means in Four Discriminant Dimensions

		Discriminant		
Occupational Group	**I**	**II**	**III**	**IV**
030 Accountant	5.4	53.6	−27.4	9.0
080 Physical scientist	−86.6	48.3	−14.2	−10.3
111 Physician	−91.5	69.5	12.1	22.2
121 Engineer, civil	−104.3	12.4	−22.3	−5.3
122 Engineer, electrical	−85.3	4.8	−13.7	8.3
123 Engineer, industrial	−49.6	36.0	6.6	−15.9
124 Engineer, mechanical	−127.1	23.5	1.2	2.4
125 Engineer, sales	−76.0	7.6	10.4	17.3
126 Specifications writer, estimator	−30.0	−2.7	−6.0	−16.5
130 Lawyer	−10.1	73.9	21.3	−7.9
150 Pharmacist	−0.2	42.9	−36.1	61.7
161 Teacher, high school miscellaneous	13.7	12.6	11.3	4.5
180 Airplane pilot	−12.4	−54.8	−4.4	21.9
190 Draftsman	−36.3	−29.5	−40.0	−22.5
230 Manager, hotel, restaurant, etc.	65.1	−13.5	−0.4	7.2
231 Manager, retail store	32.1	−1.7	1.8	10.5
270 President, vice president, etc.	−29.9	30.2	19.9	19.8
272 Office manager	10.1	29.8	−5.1	−0.3
273 Industrial, branch manager	−7.3	1.3	−1.7	28.2
275 Sales manager	9.6	16.7	23.6	−7.3
405 Salesman, household hard goods	17.8	3.9	7.3	−23.0
406 Salesman, industrial hard goods	38.6	−16.3	6.1	−2.6

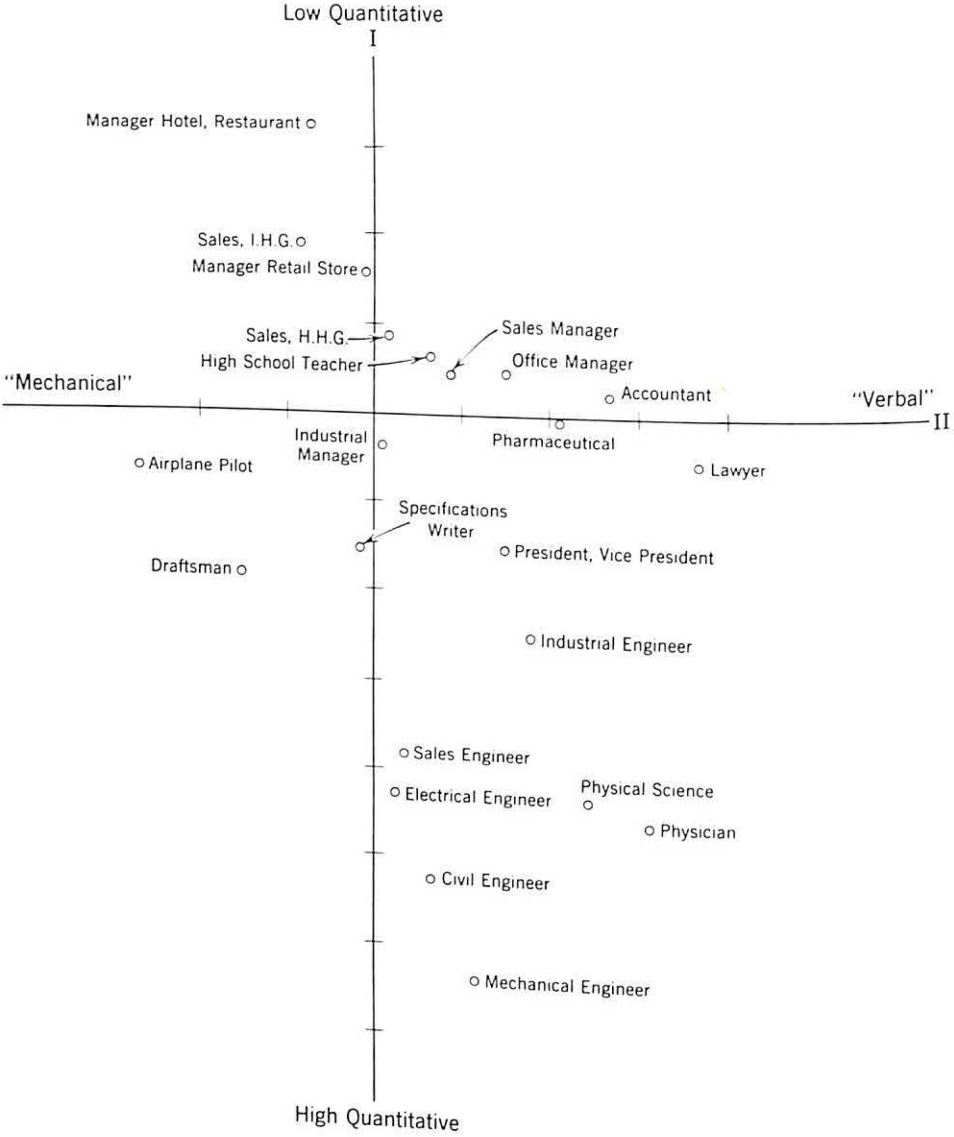


Figure 26.1 Location of occupational group means on first two discriminant axes.

The second discriminant dimension makes its sharpest separation between lawyers on the one hand and pilots on the other. Physicians, accountants, and physical scientists tend to be on the lawyers' side, and draftsmen, salesmen of industrial hard goods, and hotel and restaurant managers on the pilots' side. One can perhaps interpret this dimension as representing the balance between verbal and mechanical ability, a verbal predominance characterizing the lawyers and a mechanical predominance the pilots.

It should be noted that although the procedure used to compute the successive discriminants yields dimensions that are orthogonal over the population of individuals, the dimensions need not be orthogonal over the population of tests or over the population of jobs. Examination of the coordinates of the tests on the several vectors indicates that the vectors tend to have a moderate positive correlation over the population of tests. The scatter of points in Figure 26.1 indicates some negative correlation over jobs; those jobs that have high values on vector I tending to have low ones on vector II, and vice versa.

At this point it is necessary for us to try to arrive at some general evaluation of the results of the discriminant analysis. The first conclusion that seems to be clear is that the discrimination among these jobs is real and is not just a chance matter. However, we are equally impressed by the fact that the discrimination is not very sharp and that the overlap among different occupations is very great indeed. By far the greatest part of the variance in test scores is variance *within* jobs, and the discrimination *among* jobs is small relative to the variation within each. Even when the tests are weighted in such a way as to make the discrimination a maximum and separate the jobs as sharply from one another as is possible, the scatter of individuals within the single jobs is still a major part of the variation.

We must ask at this point why the result turned out as it did. There appear to be five main reasons that we should consider. The first thing that tends to limit our ability to make discriminations is the nature of the population of individuals with whom we were dealing. These were all men who had been previously screened on a test for admission to Aviation Cadet training. Furthermore, they had been screened by their own choice to apply for Aviation Cadet training. We have indicated in an earlier chapter that this group should be thought of as corresponding roughly to the top half of a group of high school graduates. This being so, much of the vertical discrimination in terms of level of ability that might have been accomplished in a cross section group from all parts of the population was no longer possible. The bottom half of the population had already been eliminated from our sample.

A second consideration is the nature of the sample of jobs upon which the discriminant analysis was carried out. Examination of the list will show that these were all professional or managerial jobs, or, at very best, subprofessional ones. No skilled, semi-skilled, or unskilled laboring jobs were included. No simple clerical jobs were included. In other words, we presented the tests with the most difficult task that could be demanded of them. We set them the task of discriminating among jobs at approximately the same level in the occupational hierarchy. That they failed to do this very well does not necessarily mean that they would have failed to discriminate between jobs that differed very markedly in level of abilities required. The choice of occupations was unfortunate if one's purpose was to make a demonstration of the extent to which tests can differentiate among different occupational groups. However, in our case the data for groups in the lower level occupations seemed likely to be undependable because of the prescreening referred to in the previous paragraph. Therefore, it seemed more appropriate to try the tests in a restricted range of occupations in order to see whether under these circumstances any effective degree of discrimination could be accomplished.

A third factor limiting discrimination is the limited range of attributes covered by the tests. These were all tests of aptitudes and were chosen for their relevance to one of a specific group of Air Force occupations. They did not attempt to cover the complete range of aptitudes or to deal with the interests, personality characteristics, motivations, or other factors that might be important for differentiating between, for example, an engineer and a salesman. Thus, the differentiation is limited to what can be accomplished by tests of intellectual, numerical, perceptual, motor, and mechanical abilities.

The fourth factor that must be recognized, but that does not represent a limitation peculiar to the data of our particular study, is the heterogeneity of an occupation. For example, one of our groups was composed of about 200 lawyers. However, these lawyers were engaged in various different types of legal activities. Some of them were trial lawyers, some were district attorneys, some were corporation lawyers, some were tax lawyers, and so forth. The range of different interests and emphases called for in these different jobs within the same general occupational group is probably quite large. Thus, we must recognize that in many occupations that are nominally a single occupation in terms of census or Dictionary of Occupational Titles categories, or in terms of our thinking about them, there is a wide range of specific suboccupations and specific activities. Thus, individuals with quite different characteristics and quite different interests and capabilities may still be at home in the broad scope of the occupation.

A fifth and final consideration that must be recognized as a factor is the fortuitous nature of job choice. Conceivably in a society where optimum use was made of all resources for guidance of each individual into an occupation in which he would be maximally effective, the range of variation within a given occupation might be considerably reduced.

However, it must be recognized that in our society this situation does not prevail. Individuals get into occupations for a great variety of reasons, many of which may be completely unrelated to their abilities or appropriateness for the occupation. Insofar as this is the case, we can hardly expect our tests to predict this event.

Of course, our data provide no basis for choosing between the various factors that we have indicated as possible causes for our failure to discriminate more accurately than we have. All have probably operated to some extent, and the final result is a combination of all of them. In general, our conclusion must be that although the differentiation between occupations with respect to score on a group of tests is real, still this differentiation is less sharp than the test enthusiast would suggest, in this case when the occupations are all at approximately the same level and when the tests are limited to a battery of tests of abilities. We can hardly assert that the evidence presented in our results gives strong support for using tests to guide individuals into one or another of a set of occupations all at approximately the same level in the occupational hierarchy.

APPENDIX A

Biographical Data Blank

DIRECTIONS: For each of the following questions, select the ONE most appropriate answer. Then blacken the space having the same number and letter on the answer sheet. Mark ONLY ONE answer to each item.

1. During most of your life you have lived:
    - 1–A In a large city (over 100,000).
    - 1–B In a city (10,000 to 100,000).
    - 1–C In a small town (1,000 to 10,000).
    - 1–D In a very small town (under 1,000).
    - 1–E In the country.
2. The number of books in your home is best estimated as:
    - 2–A A whole room full—a library.
    - 2–B Two or more book cases full.
    - 2–C One book case full.
    - 2–D A few books, not more than 25.
    - 2–E None, or not more than 5.
3. What tools were available in the home in which you grew up?
    - 3–A Well-equipped shop, machine tools.
    - 3–B Work bench, good hand tools.
    - 3–C A good number of hand tools.
    - 3–D A few hand tools.
    - 3–E None.

4. How far did you go in school?
   - 4–A Less than completing high school.
   - 4–B High school graduate.
   - 4–C Some college.
   - 4–D College graduate.
   - 4–E Advanced study beyond college.
5. How far in school did your father go?
   - 5–A Grade school (grade 8 or less).
   - 5–B Some high school (grades 9 to 12).
   - 5–C High school graduate.
   - 5–D Some college.
   - 5–E College graduate.
6. Your father and his parents were chiefly of:
   - 6–A American stock (2 generations).
   - 6–B Northern European stock. (English, Irish, Scandinavian, German, etc.)
   - 6–C Southern European stock. (French, Italian, Spanish, Greek, etc.)
   - 6–D Slavic stock. (Russian, Polish, etc.)
   - 6–E Other.
7. How far in school did your mother go?
   - 7–A Grade school (grade 8 or less).
   - 7–B Some high school (grades 9 to 12).
   - 7–C High school graduate.
   - 7–D Some college.
   - 7–E College graduate.
8. Your mother and her parents were chiefly of:
   - 8–A American stock (2 generations).
   - 8–B Northern European stock. (English, Irish, Scandinavian, German, etc.)
   - 8–C Southern European stock. (French, Italian, Spanish, Greek, etc.)
   - 8–D Slavic stock. (Russian, Polish, etc.)
   - 8–E Other.
9. Your parents are:
   - 9–A Very much in favor of your joining the Air Corps.
   - 9–B Somewhat in favor of it.
   - 9–C Indifferent to it.
   - 9–D Somewhat opposed.
   - 9–E Very much opposed.

10. How long ago did you first consider aviation as a serious career?
    - 10–A Within the past two months.
    - 10–B Two to six months ago.
    - 10–C Six months to one year ago.
    - 10–D One to three years ago.
    - 10–E More than three years ago.

11. During the last few years, your family has usually owned:
    - 11–A Two or more automobiles at one time.
    - 11–B One new medium or higher priced automobile.
    - 11–C A new car in the inexpensive class.
    - 11–D A second-hand automobile.
    - 11–E No automobile.

12. As an automobile driver, you are a:
    - 12–A Good safe driver.
    - 12–B Good driver but inclined to drive too fast.
    - 12–C Fair but safe driver.
    - 12–D Poor driver.
    - 12–E Don't drive.

13. Have you driven or ridden a motorcycle?
    - 13–A Have driven for over six months.
    - 13–B Have driven for less than six months.
    - 13–C Have ridden as a passenger frequently.
    - 13–D Have ridden as a passenger sometimes.
    - 13–E Have never done so.

DIRECTIONS: The following two items, 14 and 15, are *one* question. You will select the *one* best answer among the ten, rather than just among five. You will, therefore, make only one mark in the spaces on your answer sheet following the numbers 14 and 15.

14–15. Which of the following groups includes your major subject of study in college: (Mark the *one* best answer among the ten below.)
- 14–A Did not attend college.
- 14–B Foreign languages.
- 14–C Social sciences, philosophy, history, economics, law, etc.
- 14–D Education, teacher-training, etc.
- 14–E Fine arts, music, architecture, etc.
- 15–A Business, commerce, journalism, etc.
- 15–B Industrial arts, physical education, agriculture, etc.
- 15–C Biological sciences, medicine, psychology, etc.
- 15–D Physical sciences, mathematics, engineering, etc.
- 15–E English, literature, drama, etc.

16–28. DIRECTIONS: For each school or college subject listed below, you are to blacken one space to tell how well you succeeded in that subject according to the following scale:

A Exceptionally well.
B Well.
C Fairly well.
D Poorly.
E Never studied this subject.

Thus, if you did "well" in algebra, you would blacken space 16–B; if you never studied it, blacken space 16–E, etc. Include subjects studied by yourself or with tutors as well as those studied in schools.

16. Algebra.
17. Dramatics.
18. Economics.
19. English.
20. Foreign languages.
21. History.
22. Mechanical drawing.
23. Music.
24. Physical training.
25. Physics.
26. Public speaking.
27. Shop work.
28. Trigonometry.

29–43. DIRECTIONS: For each activity listed below, you are to blacken one space to indicate how well you perform that activity according to the following scale:

A Exceptionally well.
B Well.
C Fairly well.
D Poorly.
E Do not engage in this activity.

Thus, if you play football "fairly well," blacken the space 29–C; if you do not play football at all, blacken 29–E.

29. Football, rugby, or soccer.
30. Basketball, hockey, or lacrosse.
31. Baseball or soft ball.
32. Boxing, wrestling, or water polo.
33. Crew, rowing, or canoeing.
34. Tennis, handball, ping pong, or badminton.
35. Diving or ski-jumping.

36. Marksmanship (rifle, pistol, trapshooting, etc.).
37. Sailboating.
38. Auto racing, motorcycle racing, or motorboat racing.
39. Swimming.
40. Track (dashes or hurdles).
41. Track (running events 440 yards or longer).
42. Field events (discus, shot put, etc.).
43. Horsemanship.

44–54. DIRECTIONS: For each activity listed below, you are to blacken one space to indicate *how often you have done it*, according to the following:

A Frequently.
B A number of times.
C Once or twice.
D Never, but could probably do it.
E Doubt that you could.

44. Adjust a clock.
45. Sell an article to a customer.
46. Write a technical report.
47. Arrange a club entertainment.
48. Write an essay or poem.
49. Interview men for a job.
50. Arrange a flower garden.
51. Repair a radio set.
52. Solicit contributions for a charity.
53. Make a speech.
54. Adjust a carburetor.

DIRECTIONS: For all of the remaining questions, you may mark MORE THAN ONE answer if more than one answer is true. There are only five more questions to be answered. Each of these five questions has from five to twenty printed answers. Mark the appropriate space on your answer sheet for EVERY ANSWER that is true for you. You are NOT limited to one answer for each question.

55–57. In which of the following activities or hobbies have you been so interested that you have devoted considerable time and energy to them? (Mark *one or more* in items 55–57, as many as may apply.)

55–A Amusements (dancing, movies, etc.).
55–B Painting, sketching.
55–C Music.
55–D Collecting (stamps, coins, etc.).
55–E Dramatics.

56–A Creative writing, poetry, etc.
56–B Journalism, school paper, etc.
56–C Boy Scouts.
56–D Photography.
56–E Amateur motion pictures.
57–A Woodworking, cabinetmaking.
57–B Sheet-metal work.
57–C Metalworking, machine shop.
57–D Automobile repairing or rebuilding.
57–E None of the activities in items 55, 56, or 57.

58. Which of the following have you done: (Mark *one or more,* as many as may apply.)

58–A Built nonflying model planes.
58–B Built rubber or gas-powered model planes.
58–C Participated in model plane contests.
58–D Built or assisted in building a glider or plane.
58–E None of these.

59. Have any of the following ever been a licensed airplane pilot? (Mark *one or more*—as many as may be true.)

59–A Your father or mother.
59–B Your brother or sister.
59–C Your uncle, aunt, cousin, or other relative.
59–D Your close personal friend (not in family).
59–E None of these.

60–63. Mark the space to indicate *any* of the following types of work that you have done *at any time,* and for which you have received remuneration. (Mark *one or more,* as many as may apply.)

60–A Unskilled manual (laborer, construction crew, janitor, etc.).
60–B Semi-skilled manual (operator in factory, filling station, truck driver, seaman, etc.).
60–C Skilled manual (machinist, mechanic, electrician, etc.).
60–D Minor supervisory (supervisor, foreman, farm manager, etc.).
60–E Engineering (engineer, draftsman, surveyor, etc.).
61–A Simple clerical (office clerk, timekeeper, etc.).
61–B Higher office work (accountant, appraiser, etc.).
61–C Salesman—in store, canvassing, etc.
61–D Salesman—automobile, wholesale, real estate, etc.
61–E Managerial (manager, executive, etc.).
62–A Academic (teacher, librarian, assistant, etc.).
62–B Scientific (research worker, chemist, etc.).
62–C Instructor or leader (camps, Y. M. C. A., etc.).

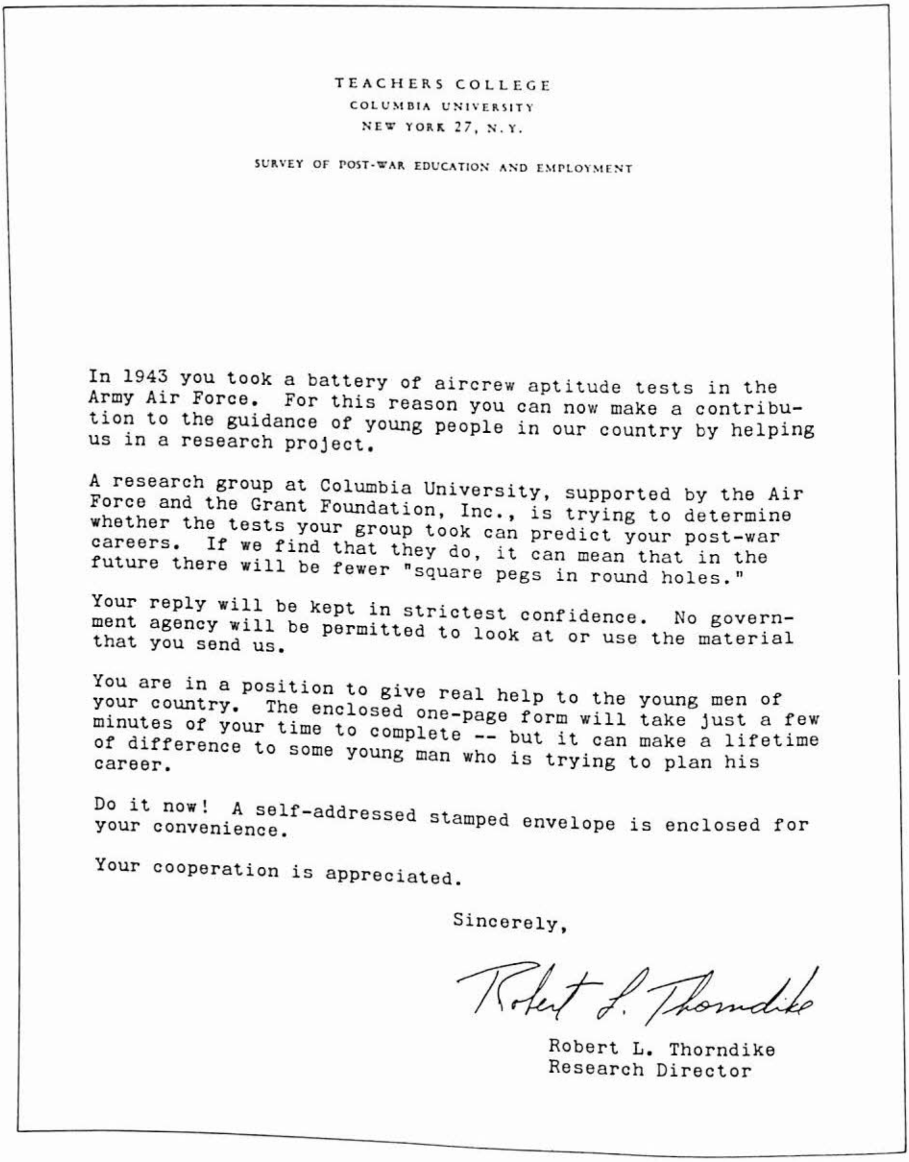
62–D Semi-professional (photographer, pharmacist, etc.).
62–E Public relations (reporter, lawyer, advertising, etc.).
63–A Personal service (waiter, barber, bell boy, usher, etc.).
63–B Entertainer (actor, musician, etc.).
63–C Protective service (policeman, fireman, guard, watchman, etc.).
63–D Social service (social worker, probation officer, etc.).
63–E None

64–65. Why do you want Aviation Cadet training? (Mark *one or more* in items 64 and 65.)

64–A I like the adventurous life.
64–B It is the best way to serve the nation.
64–C Feel that I have aptitude for flying.
64–D Prefer aviation duties to other types of military service.
64–E The salaries are higher than in other branches of the army.
65–A Expect to use flight training after leaving the army.
65–B Was persuaded by other persons.
65–C To get away from home and be on my own.
65–D Just suddenly decided.
65–E To prove to myself that I can make good.

APPENDIX B

Letters Sent to All Members of Survey Sample



TEACHERS COLLEGE
COLUMBIA UNIVERSITY
NEW YORK 27, N.Y.

SURVEY OF POST-WAR EDUCATION AND EMPLOYMENT

In 1943 you took a battery of aircrew aptitude tests in the Army Air Force. For this reason you can now make a contribution to the guidance of young people in our country by helping us in a research project.

A research group at Columbia University, supported by the Air Force and the Grant Foundation, Inc., is trying to determine whether the tests your group took can predict your post-war careers. If we find that they do, it can mean that in the future there will be fewer "square pegs in round holes."

Your reply will be kept in strictest confidence. No government agency will be permitted to look at or use the material that you send us.

You are in a position to give real help to the young men of your country. The enclosed one-page form will take just a few minutes of your time to complete -- but it can make a lifetime of difference to some young man who is trying to plan his career.

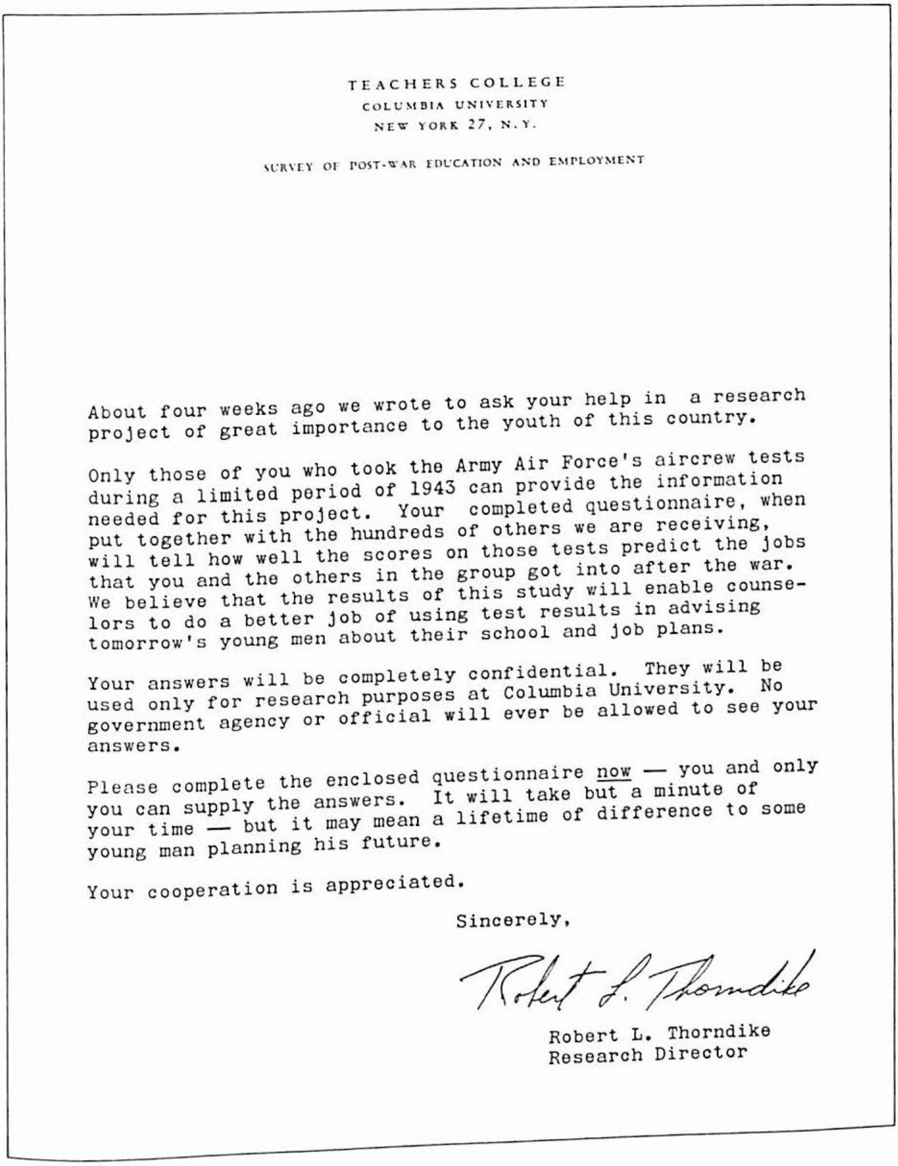
Do it now! A self-addressed stamped envelope is enclosed for your convenience.

Your cooperation is appreciated.

Sincerely,

Robert L. Thorndike

Robert L. Thorndike
Research Director



TEACHERS COLLEGE
COLUMBIA UNIVERSITY
NEW YORK 27, N.Y.

SURVEY OF POST-WAR EDUCATION AND EMPLOYMENT

About four weeks ago we wrote to ask your help in a research project of great importance to the youth of this country.

Only those of you who took the Army Air Force's aircrew tests during a limited period of 1943 can provide the information needed for this project. Your completed questionnaire, when put together with the hundreds of others we are receiving, will tell how well the scores on those tests predict the jobs that you and the others in the group got into after the war. We believe that the results of this study will enable counselors to do a better job of using test results in advising tomorrow's young men about their school and job plans.

Your answers will be completely confidential. They will be used only for research purposes at Columbia University. No government agency or official will ever be allowed to see your answers.

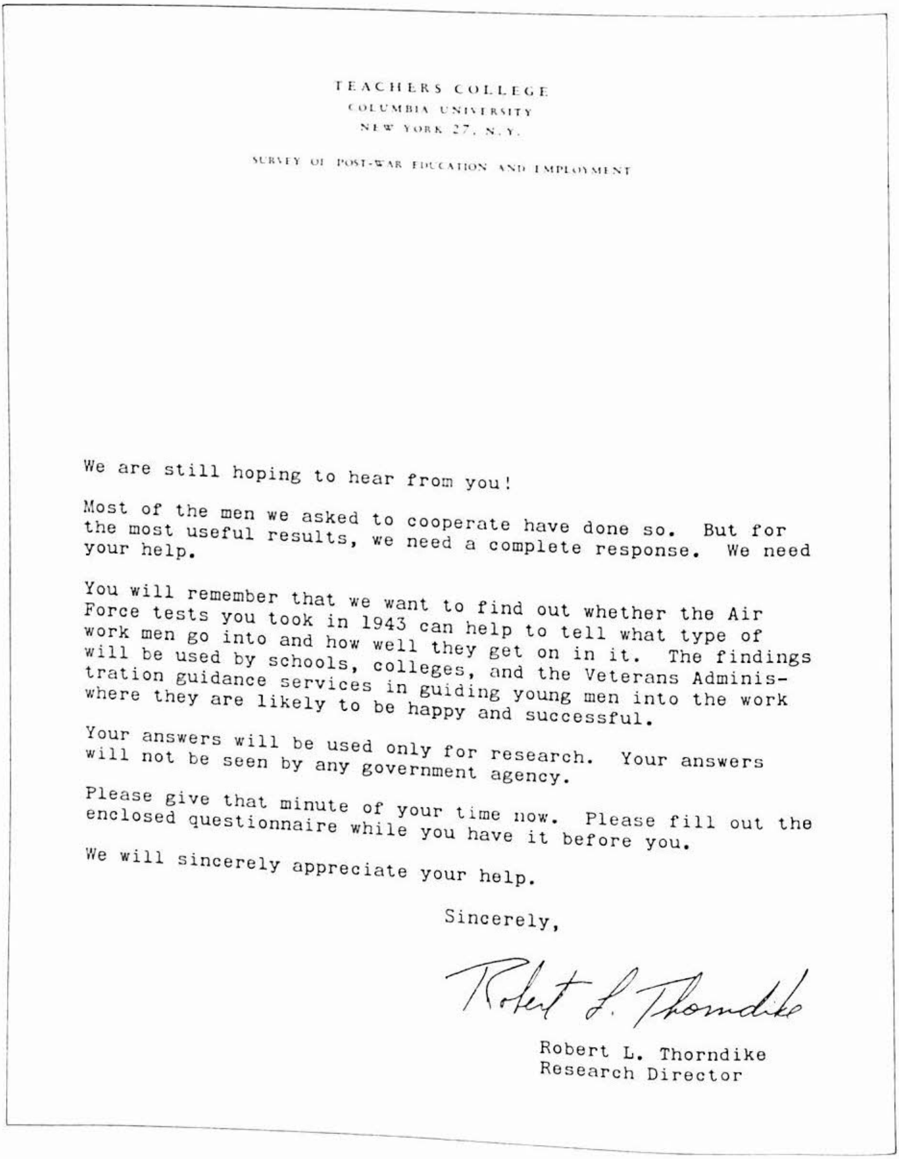
Please complete the enclosed questionnaire now — you and only you can supply the answers. It will take but a minute of your time — but it may mean a lifetime of difference to some young man planning his future.

Your cooperation is appreciated.

Sincerely,

Robert L. Thorndike

Robert L. Thorndike
Research Director



TEACHERS COLLEGE
COLUMBIA UNIVERSITY
NEW YORK 27, N.Y.

SURVEY OF POST-WAR EDUCATION AND EMPLOYMENT

We are still hoping to hear from you!

Most of the men we asked to cooperate have done so. But for the most useful results, we need a complete response. We need your help.

You will remember that we want to find out whether the Air Force tests you took in 1943 can help to tell what type of work men go into and how well they get on in it. The findings will be used by schools, colleges, and the Veterans Administration guidance services in guiding young men into the work where they are likely to be happy and successful.

Your answers will be used only for research. Your answers will not be seen by any government agency.

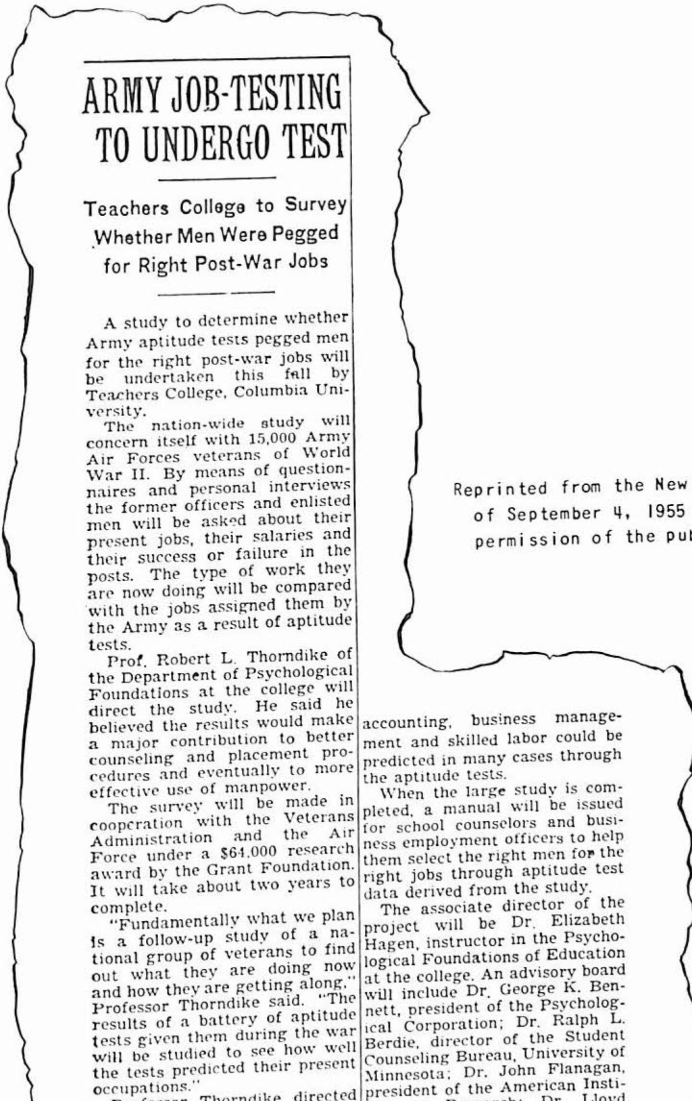
Please give that minute of your time now. Please fill out the enclosed questionnaire while you have it before you.

We will sincerely appreciate your help.

Sincerely,

Robert L. Thorndike

Robert L. Thorndike
Research Director



ARMY JOB-TESTING TO UNDERGO TEST

Teachers College to Survey Whether Men Were Pegged for Right Post-War Jobs

A study to determine whether Army aptitude tests pegged men for the right post-war jobs will be undertaken this fall by Teachers College, Columbia University.

The nation-wide study will concern itself with 15,000 Army Air Forces veterans of World War II. By means of questionnaires and personal interviews the former officers and enlisted men will be asked about their present jobs, their salaries and their success or failure in the posts. The type of work they are now doing will be compared with the jobs assigned them by the Army as a result of aptitude tests.

Prof. Robert L. Thorndike of the Department of Psychological Foundations at the college will direct the study. He said he believed the results would make a major contribution to better counseling and placement procedures and eventually to more effective use of manpower.

The survey will be made in cooperation with the Veterans Administration and the Air Force under a $64,000 research award by the Grant Foundation. It will take about two years to complete.

"Fundamentally what we plan is a follow-up study of a national group of veterans to find out what they are doing now and how they are getting along," Professor Thorndike said. "The results of a battery of aptitude tests given them during the war will be studied to see how well the tests predicted their present occupations."

Professor Thorndike directed a similar but smaller-scale study that took a year and a half to complete. He said it demonstrated the feasibility of a larger project and indicated that the Air Force tests had value in predicting the chances of a man entering a certain occupation and his success in it. The earlier survey was confined to 1,500 cases. It showed that success in such occupations as engineering, accounting, business management and skilled labor could be predicted in many cases through the aptitude tests.

When the large study is completed, a manual will be issued for school counselors and business employment officers to help them select the right men for the right jobs through aptitude test data derived from the study.

The associate director of the project will be Dr. Elizabeth Hagen, instructor in the Psychological Foundations of Education at the college. An advisory board will include Dr. George K. Bennett, president of the Psychological Corporation; Dr. Ralph L. Berdie, director of the Student Counseling Bureau, University of Minnesota; Dr. John Flanagan, president of the American Institute of Research; Dr. Lloyd Humphrie, director of the human resources and research division of the Air Force; Dr. Joseph Samler, head of the counseling division of the Veterans Administration; Dr. John Wilson, director of the biological science division of the National Science Foundation, and Dr. Dael L. Wolfle, a member of the Scientific Manpower Commission.

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